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**1 ST AIR DIVISION
(METEOROLOGICAL SURVEY)
STRATEGIC AIR COMMAND**

**FINAL REPORT
PROJECT 119 L**

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FINAL REPORT

PROJECT 119L

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1ST AIR DIVISION (METEOROLOGICAL SURVEY)

FINAL REPORT

PROJECT 119L

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Brigadier General, USAF
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ADDENDUM

I. A cut-off date of 5 March 1956 was established for compilation of statistics on this operation. Subsequent to that date the following vehicles, which were originally entered in the basic report as "Successful Launches", have been recovered in the European area. No transmissions were received from these balloons. For any gross analysis of the statistics contained in this report the category for the following enumerated balloons should be changed from "Successful Launch" to "Failure" or "Stray" as indicated below: (C)

A. Failures:

Flight Number	Line Number	Balloon Serial Number	Type	
ADA 109	2114	648	66CT	
ADA 116	2124	655	66CT	
ADA 150	2109	676	66CT	
ADA 151	2110	646	66CT	
GIE 96	5097	704	66CT	
EVA 71	1071	826	66CT	(C)

B. Strays:

EVA 88	4088	353	66CT	
ADA 35	2035	19	66CT	(C)

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CHAPTER I

GENERAL SUMMARY

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I. INTRODUCTION:

A. General: This is the Final Report of Project 119L conducted by Strategic Air Command through the 1st Air Division (Meteorological Survey). This report is intended to cover the primary mission for which Weapons System 119L was designed, plus related pre and post mission activities. In the event a more complete analysis of the project is contemplated, reference must be made to those documents listed in Chapter V plus data available to Air Force Cambridge Research Center, ARDC. Weapons System 119L is described in Tabs "A" and "B", Chapter III. (C)

B. Mission: To obtain photographic and electronic reconnaissance of the Union of Soviet Socialist Republics and its satellites using Weapons System 119L. (TS)

C. Assignment of Mission: Weapons System 119L was developed by Air Force agencies and civilian institutions for the purpose of conducting pioneer reconnaissance by use of high altitude balloons. Headquarters USAF monitored this project during the initial planning and development stages by direct coordination with individual commands. It became apparent that a single command was required to further develop, coordinate and conduct the operation. The Strategic Air Command was assigned this responsibility in USAF letter, Subject: "Assignment of Additional Mission to Strategic Air Command", dated 21 March 1955. (TS)

D. Activation of 1st Air Division: To accomplish the mission, Strategic Air Command activated the 1st Air Division at Offutt Air Force Base in SAC General Order Number 26, dated 15 April 1955. The Mission of 1st Air Division was established in SAC Regulation Number 23-7, dated 15 June 1955. (U)

E. Concept of Operations: The basic concept was to accomplish launches from Western Europe. Balloons were expected to transit the target area in seven to ten days and then be tracked and recovered within the Far East and Alaskan areas. (TS)

1. Initial Schedule of Actions: The most favorable period for launch was determined to be 1 November through 1 May during which period the prevailing winds were predicted to be West to East at all altitudes. This was therefore established as the period during which the operation would be conducted. Based on this period of favorable winds it was planned to conduct Zone of Interior Operational Suitability Testing and Training during the period May 1955 through September 1955. There would then remain sufficient time for the units involved to deploy to forward bases and prepare such bases prior to the implementation date, 1 November 1955. (S)

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2. Organization:

a. 1st Air Division was assigned operational control of the 456th Troop Carrier Wing (TAC), equipped with C-119 aircraft for recovery operations; 1110th Air Support Group (HEDCOM), the balloon launching organization; and the 6926th Radio Squadron (Mobile) (USAFSS), to perform the tracking function. Because of the peculiar nature of the mission, responsibility for operational control of the launch and recovery units was almost immediately expanded to include responsibility for training units and crews. This expansion of responsibility was accomplished by mutual agreement, between the Commander, 1st Air Division, and the Commanders of the parent commands. Also, because of the tremendous quantities of material involved which required shipment overseas to meet deadline dates, it became apparent that 1st Air Division should be given the responsibility of monitoring procurement, development, shipping, etc. Accordingly, these logistical responsibilities were also transferred by mutual consent of commanders concerned. (TS)

b. 1st Air Division established Detachment 1, 1st Air Division, [at High Wycombe, England,] as a forward command post for the purpose of coordinating launch, support and public information requirements and effecting necessary liaison with supporting agencies. This detachment was activated 9 June 1955. Its mission was later expanded to include the requirement to exercise operational control of all European area launches. Headquarters 1110th Air Support Group, [also established at High Wycombe,] directed the activities of the five launch detachments. (S)

c. Headquarters 456th Troop Carrier Wing was established at [Shiroi AB, Japan] and functioned as a forward command post for the purpose of coordinating tracking, recovery and public information requirements and effecting necessary liaison with supporting agencies in the Far East. The 456th Troop Carrier Wing exercised operational control over tracking and recovery activities. (S)

d. A graphic presentation of command relationship is contained on the following page. (U)

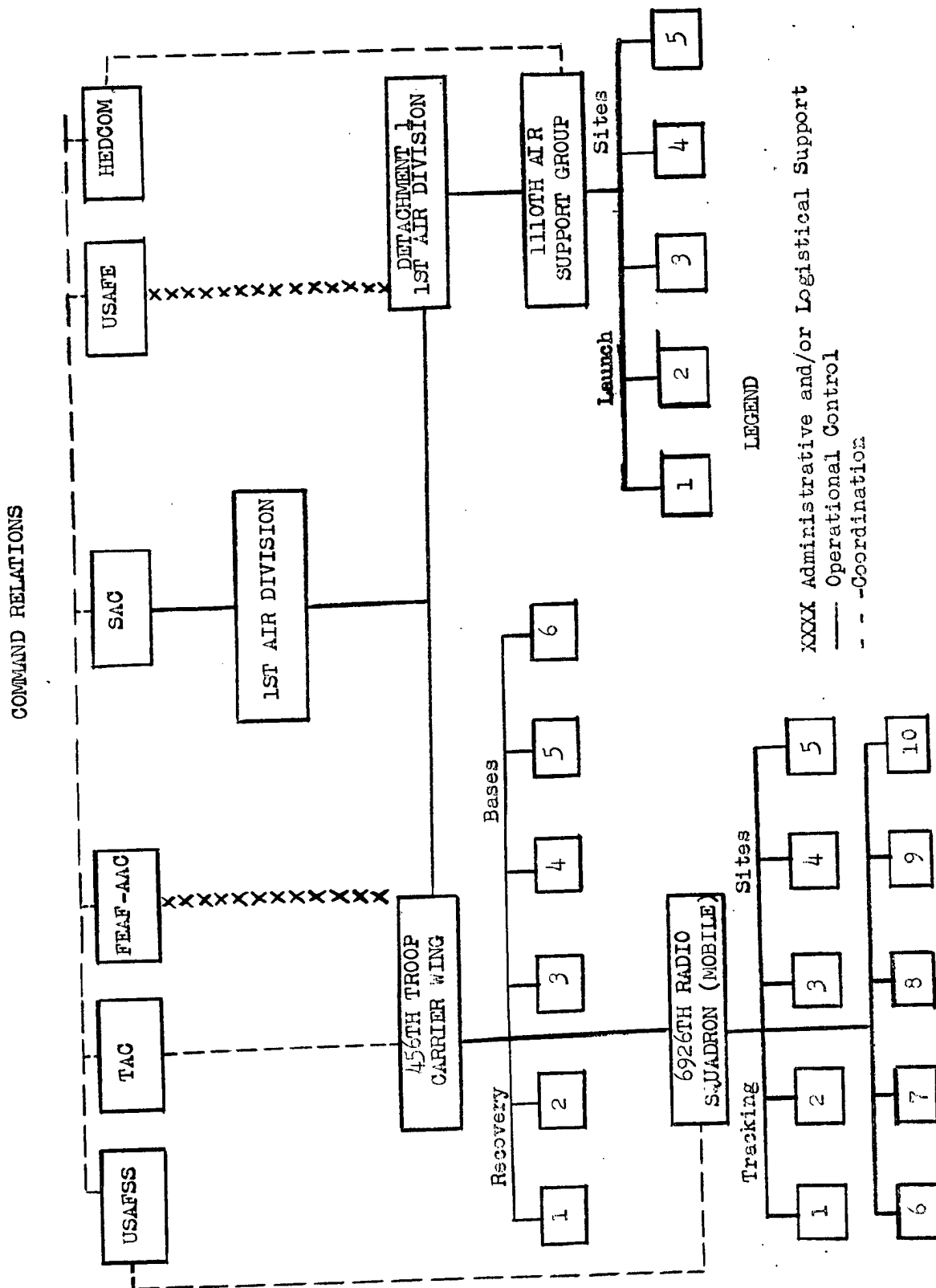
3. Selection of Operational Sites:

a. Prior to assignment of Project 119L to Strategic Air Command, it was considered that all balloons should be launched from Scotland. A further study of meteorological data indicated that more complete coverage could be obtained if sites were widely dispersed in Western Europe; besides, surface weather [in Scotland] was expected to be unsuitable for launch activities a large part

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of the time. In addition, the distance from the area of interest resulted in a day or so of balloon travel before the photographic mission could be started, an important factor when the criticality of balloon life expectancy is considered. Based on studies of trajectory and surface weather, general areas for the location of launch detachments were selected. [They were Eastern Norway, West Germany, and Turkey. It was also decided to retain one site in Scotland as a matter of political expediency.] After selection of the general areas, USAF directed that specific locations be selected by CINCUSAFE. This permitted consideration of logistical feasibility, physical adequacy, and other pertinent information pertaining to the theater and known to USAFE Headquarters. Criteria for physical adequacy to support balloon operations were stated by 1st Air Division. [Final selections were Evanton, Scotland; Gardermoen, Norway; Giebelstadt and Oberpfaffenhofen, Germany; and Adana, Turkey. An alternate site was selected at Buckeburg, Germany, for use in event that operations were denied at one of the primary locations (use of this site did not become necessary).] In June 1955, the Commander, 1st Air Division, and members of his staff visited each of the primary sites with a view toward inspecting the physical facilities available and stating specific requirement for site preparation. [During this visit to Europe, the 1st Air Division Commander, with representatives from USAF and USAFE coordinated the balloon launching mission with high officials in each of the four countries concerned. (TS)]

b. The three squadrons of the 456th Troop Carrier Wing were divided into detachments comprised of eight C-119 aircraft each and placed at recovery sites believed to be compatible with the predicted upper air trajectories. [These sites were Kadena AB, Okinawa; Adak NAS, Alaska; Kodiak NAS, Alaska; Itazuke AB, Japan; Misawa AB, Japan; and Johnson AB, Japan. In addition to these primary locations, Clark AFB, P. I., and Midway NAS were designated as alternate recovery bases to be used as required. Central AB, Iwo Jima was initially planned as a primary location, however, due to extensive typhoon damage to air base facilities, Itazuke AB, Japan was selected as a replacement base. (S)]

c. Location of tracking sites was predicated upon the forecasted flow of balloons into the recovery area and the requirement to obtain adequate "cuts" of lines of position (bearings) to establish fixes. [Tracking detachments were located at Shiroi AB, Japan; Northwest Field, Guam; Wake Island; Clark AFB, P. I.; Yontan AB, Okinawa; Pyongtaek AB, Korea; Chitose, Japan; Midway Island; Shemya and Elmendorf AFB, Alaska.] At termination of the project an additional site had been activated at Nome, Alaska, due to a requirement based on experience gained during actual operations, and Formosa was being surveyed to determine the feasibility of locating a site on that island. (S)

4. Communications:

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a. The 1st Air Division communications network was composed of commercially leased and allocated military teletype circuits. The network was parallel to command control channels; i.e., from the launch sites to the Launch Control Center (High Wycombe) from the recovery base to the Recovery Control Center (Shiroi); and from Headquarters 1st Air Division to both the Launch and Recovery Control Centers. The network was equipped with on-line encryption devices and all messages transmitted via the network were classified a minimum of Confidential and encrypted during transmission, for the purpose of maintaining communications security. (C)

5. [Cover Plan: Meteorological Research was established as the basis for the primary mission cover plan and for this purpose the suffix "Meteorological Survey", was added to the 1st Air Division designator. This cover plan explained the mission as being in consonance with other USAF high altitudes meteorological balloon projects, some of which had received considerably publicity, e.g., Project Moby Dick. The responsibility for development, publication and monitoring of the cover plan was vested initially in Headquarters 1st Air Division and was contained in 1st Air Division Operations Plan Project (C) (codeword), dated 10 June 1955. This plan emphasized that no voluntary press releases would be made. When questioned directly, unit personnel would divulge only, but freely, the unclassified meteorological aspect of the mission. (TS)]

II. TRAINING PHASE:

The training phase for ZI units was originally scheduled for the period 10 May to 1 September 1955, leaving a month for deployment and a month for shakedown overseas. However, due to the fact that equipment non-availability resulted in very little activity during the month of July and the fact that equipment deficiencies dictated further testing prior to beginning operations, decision was made by Headquarters USAF that the operational date would be postponed 30 days (from 1 November to 1 December 1955). [This decision was further influenced by a request for 30 day postponement from the British in order to avoid commencement of operations prior to completion of certain diplomatic negotiations which were under way.] This decision and other considerations made it possible to extend the training phase until mid-October. (TS)

A. Moby Dick Hi: Limited information was available concerning balloon operations, therefore 1st Air Division conducted Moby Dick Hi operations in The Zone of Interior during the period 10 May 1955 through 16 October 1955 for the purpose of testing operational suitability, developing procedures and tactics, resolving deficiencies, determining capabilities and accomplishing on-the-job training. Originally, only twenty-five balloon systems were to be

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provided for this project; however, 1st Air Division estimated that a minimum of 150 would be needed if the testing and training were to be accomplished on an acceptable basis. A requirement for this number of systems was established, and later was slightly increased. The final report on this operation is contained in 1st Air Division TOP SECRET document entitled "Final Report of Operational Suitability Test Project 119L". (S)

1. Training: With initial guidance from AFCRC and General Mills (balloon manufacturer), the training and suitability testing of the system was conducted in the Zone of Interior in accordance with 1st Air Division Operations Order 201-55. (C)

a. Launch: During project Moby Dick Hi the 1110th Air Support Group launched 162 119L systems. These launchings provided the only opportunity for development of procedures and the accomplishment of initial and final training prior to actual operations. (C)

b. Hydrogen Generation: It was anticipated that the hydrogen gas required for Moby Dick Hi would be produced by primary mission generators at Francis E. Warren AFB, Wyoming. Initially these generators proved incapable of providing the required quantities and quality of hydrogen. Major revisions in procedures and adaptations of mechanical aids rendered the system serviceable. (C)

c. Tracking: Moby Dick Hi balloons were tracked by USAFSS, FCC, and AACS. No training was accomplished by the 6926 Radio Squadron (Mobile) (primary mission tracking unit), since it was manned at overseas stations during and subsequent to the Moby Dick Hi operation. (See paragraph IIB below.) (C)

d. Recovery: Recovery operations were conducted by the 456th Troop Carrier Wing operating from their home base at Charleston AFB, South Carolina. Air-to-air and air-to-surface recovery techniques were without precedent and the first SOP's for such were developed during the Moby Dick Hi operation. Air-to-air recovery action was successfully accomplished on twelve of the thirty-nine systems on which attempted recoveries were possible. As of completion of Moby Dick Hi, the air-to-water recovery tactic had not proven successful due to water station deficiencies. (S)

2. Operational Suitability Test: During Moby Dick Hi, techniques of varying balloon initial floating altitudes were investigated and developed into SOP. Also it was found that ascent rates and hydrogen purity were less critical than previously believed. It was also determined that the basic equipment for primary mission operations was adequate with the following major exceptions: (C)

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a. The 128TT balloon was determined to be marginally serviceable. The unacceptably high failure rate of this balloon type (approximately 50%) which was experienced through the month of August, led to a decision that the contract for this type should be terminated at the mid-point and the 66CT balloon substituted for the remainder. Although not fully tested at the time, the 66CT was the only other balloon in the inventory capable of doing the job and had been developed expressly for this project. Because of its cylindrical design it was thought to be stronger structurally and less apt to fail under stresses of ascent. It had similar life expectancy, but flew at lower maximum altitudes (45,000 - 60,000 as compared to 75,000 - 85,000) than the 128TT. At the lower altitudes it picked up faster winds and, as a result, doubled the expected rate of arrival in the recovery area. A disadvantage was the possibility of increased vulnerability; however, ADC was unable to demonstrate that the increase would be greater than slight in attempting to locate and intercept the small number (15-20) of these balloons launched in the ZI. As a result of the decision to convert the contract from the large balloon to the smaller one, there were approximately 1,300 of the 128TT type and 1,500 of the 66CT type available for accomplishment of the primary mission. (TS)

b. Minor mechanical innovations and a major revamping of procedures were required to render the gas generation system serviceable. (U)

c. The degree of success to be expected from air-to-air and air-to-water tactics remained in doubt. (S)

d. Launch Device: The forklift launch vehicle was determined to be inadequate and unsafe due to size, weight, limited visibility and limited mobility. The forklift was replaced with the Fisher Launcher, which was a 2½ ton 6X6 truck with a super-imposed structure from which the gondola was suspended and released. (U)

3. Vulnerability Test: During Moby Dick Hi, a test was conducted to determine the vulnerability of the 119L system. To accomplish this test Air Defense Command instructed subordinate units to attempt detection and termination of Moby Dick Hi balloons to maximum degree short of interference with the ADC primary mission. During the test ADC was advised of launch times, expected trajectories, and balloon fixes as they became available. Results indicated a limited capability to track balloons using either radar or ground observers. It was demonstrated that balloons at altitudes attainable by fighter aircraft could be destroyed by fighter action if located. It was concluded that the degree of vulnerability to be expected would be directly proportional to enemy capability to

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locate and track the balloons. Although inconclusive insofar as Russian radars were concerned, test results did not indicate radar tracking capability to be good, (See Tab I, Chapter III), and it was estimated that the balloon system was not unacceptably vulnerable. (TS)

B. Moby Dick Far East: The Moby Dick Far East program (1st Air Division Operations Order 202-55) was established primarily to provide training for, and to obtain factual information on the capabilities and limitations of, the 6926th Radio Squadron (Mobile). This was done by simulating primary mission operations in the Far East and Alaska areas during the period 7 September 1955 to 27 December 1955. A total of 211 Moby Dick [Far East] balloons were launched by two launch teams from sites in [Okinawa, Japan, and Korea]. All phases of the tracking functions were exercised during this period. After 23 November 1955 the balloons carried VHF transceivers, which made it possible for recovery crews to fly realistic training missions actually intercepting and homing on balloon signals. Additional benefits derived from this project were: (S)

1. Provided information on frequency propagation characteristics. (U)
2. Provided additional trajectory information. (U)
3. Served to add considerably to the cover plan. (C)

C. Command Post Exercises: Commencing in late October 1955, Command Post Exercises involving the primary mission communications network were conducted almost continuously to provide maximum training for all personnel and test the adequacy of the system. Each exercise was approximately 5 days duration with a short break of 2 to 3 days to evaluate results. These exercises were planned to simulate balloon launching, tracking, fixing and recovery operations. Wherever possible command functions and procedures were employed to add realism. Applicable reports required by 1st Air Division Manual 55-8 were submitted and Air Weather Service support capability and other facets of the operation were exercised. (S)

III. DEPLOYMENT PHASE:

A. The deployment schedule of launch and recovery unit personnel and equipment was finally predicated upon the designated date for commencement of operations and the requirement to attain operational proficiency prior to deployment. Also it was desired to have all operational units in place as far in advance of the

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implementation date as possible to assure time for base "shake-down" and mission preparation. As previously stated, the target date for commencement of operations was advanced from 1 November to 1 December 1955. See Part I, Chapter II. (C)

1. 6926th Radio Squadron (Mobile): Deployment responsibility for tracking units was retained by USAFSS, since personnel were to be obtained from USAF-wide resources and USAFSS intention was to reassign such personnel and equipment within the Far East upon termination of the project. Deployment of personnel and equipment was commenced in June 1955 and was completed in August 1955. 725 personnel and 1,280,000 pounds of equipment were involved in this deployment. (C)

2. 1110th Air Support Group: Deployment of the main body of the 1110th Air Support Group commenced on 10 October and was completed on 1 November 1955. A total of 743 personnel and 477,500 pounds of equipment were involved. (U)

3. 456th Troop Carrier Wing: Deployment of the main body of the 456th Troop Carrier Wing commenced on 5 October and was completed on 20 November 1955. A total of 1,763 personnel, 2,751,290 pounds of cargo and 50 C-119 aircraft were involved. (U)

B. There were 27,000,000 pounds of special equipment (Grand Union) shipped in support of this operation in addition to the previously mentioned equipment. This, plus other commitments, equaled an approximate overall total of 3,231 personnel and 32,000,000 pounds of cargo. (S)

IV. PRE-OPERATIONAL DECISIONS:

A. Ground Cut-Down Stations: The original plan of operations called for high altitude operation (80,000 ft) of the 128TT balloon where winds were expected to be of moderate speeds posing a reasonable problem for intercepting C-119 aircraft. As a result, electronic balloon termination equipment was installed in project aircraft and no other means of termination was provided. The decision made during Moby Dick Hi to employ 66CT balloons (which fly at lower altitudes) in approximately equal numbers to the 128TT required a re-evaluation of termination and recovery plans. It was indicated that at the lower altitudes, wind speeds encountered would be such as to nearly double the expected rate of arrivals in the recovery area. Also, proximity to jet stream altitudes on arrival would result in rapid transit of the recovery area such that balloons might arrive during night and adverse weather, transit the area, and pass far beyond before aircraft could intercept them. It was known that under these conditions the balloon would travel at such speeds as to render

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overtaking by C-119 aircraft impossible. It was immediately apparent that a requirement existed for a means to terminate balloons from the ground. From spare airborne electronic equipment available, ground cut-down stations were established at [Shiroi Air Base] and at each of the recovery squadron bases except [Johnson Air Base]. To improve performance a specially constructed Yagi antenna was used. The range of these stations was such that unbroken ground cut-down coverage was provided from the northern tip of Formosa to the northern tip of Hokkaido, around Adak, and around Kodiak. During the operation, an additional station was established at [Niigata, Japan]. The concept of employment of these ground cut-down stations contemplated that at night, during adverse weather, or in the absence of aircraft for the purpose, balloons would be terminated by the ground stations [so as to fall in the Japanese Sea as close to the West shore of Japan as possible, or fall on Japan.] It was thought, and later confirmed, that there would be little possibility of recovering gondolas from the open Pacific. In addition to requiring ground cut-down stations, the increased speed of the balloons required that the exposure rate of the duplex camera be changed from $12\frac{1}{2}$ minutes to $6\frac{1}{4}$ minutes, to assure overlapping coverage. (TS)

B. Surface Recovery Support: With the expected increase in arrival rate and the installation of ground termination equipment, it was anticipated that many gondolas would fall on land with no opportunity for recovery by the C-119 aircraft, or in water where the aircraft recovery effectivity would depend upon state of the sea and proper functioning of the unproven water station. Based on these considerations a decision was made that supplementary recovery support was required. Through FFAF and AAC arrangements were made with CINCAL, CINCFE, and CINCPAC for recovery assistance from all United States forces operating within their theaters. News releases in the theaters solicited the cooperation of civilians by offering a reward for returned gondolas. Plans made were complete and detailed, and later proved to be most effective. (S)

C. Preparations for Launch: In anticipation of starting the operation on 1 December 1955, action was taken to be prepared to launch from each site at the maximum rate, from the first day. These preparations included the generation and storage of hydrogen, and stockpiling of prepared systems in the mechanical and electrical configuration required. (S)

D. Stipulations by Higher Headquarters:

1. Cover Plan Launches. USAF directed that cover plan balloon launchings be conducted in the Pacific area concurrently with the conduct of the primary mission. This operation was nicknamed White Cloud and was implemented by 1st Air Division Operations

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Order 207-56; it provided for the launching of ten 124A type balloons each at [Okinawa], Hawaii, and Alaska during the period 9 January 1956 to July 1956. The first of these balloons was launched on 9 January 1956 with complete press coverage. This was one day prior to commencement of primary mission operations as had been requested by the State Department. (TS)

2. Placards: At the direction of USAF, a cartoon placard, multilanguage placard and Russian language placard were affixed to that part of the gondola housing the cameras. The placards indicated that a monetary reward would be given if the package were turned over to the proper authorities. Due to delayed delivery, the Russian language placard was affixed first on 23 January 1956, 13 days after the operation began. (S)

3. Launch Limitations: For the first seven days of operation, launchings were restricted by Headquarters USAF to a total of ten effective balloons per each 24 hour period with an altitude ceiling restriction of 55,000 feet. (Note: An effective balloon is one which has been successfully launched, reaches planned altitude, and can be assumed to penetrate the area of interest.) (S)

4. 2G-B0 (Auxiliary Safety Unit): Safety measures against free fall of the equipment in the event of balloon failure during and after ascent were provided the 119L system by a safety chute and by the electronic package control unit. To give back-up protection against free fall, in addition to the above, USAF determined that an auxiliary safety unit, the 2G-B0, would be included in the system. Delivery of the 2G-B0 to launch detachment was subsequent to termination of the primary mission, therefore it was never actively employed. (C)

5. Locator Beacon: In May 1955 a requirement was stated for a locator beacon which, attached to the gondola, would send signals from a downed position to direct searchers to the location. Without such a beacon it was considered that downed gondolas would be difficult to find on land and practically impossible to find in water. For technical reasons, development was limited to a beacon which would work in water but not on land. It was designed with a salt water activated battery to transmit a UHF signal for 48 hours to a range of 100 - 150 nautical miles. Recovery aircraft and the Air Rescue aircraft were capable of homing on these signals using the AN/ARC-27 with the AN/ARA-25 homing adapter. Early attempts to test prototype and first production models of the beacon were inconclusive, and considerable delay was experienced in getting first article approval. However, because the beacons were known to be capable of functioning, 501 were accepted and shipped to launch sites for use prior to receipt of first article approval. This approval was received on 4 January 1956. A beacon was to be attached to each system launched. (S)

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E. Planned Configuration: The configuration of balloon-gondola assemblies planned for the beginning of operation was in consonance with other operational decisions and was standardized for all launches regardless of balloon type. Principal features were: (C)

1. Basic configuration was normal, consisting of balloon, load straps, rotator, bar assembly, parachute cluster, water station, DMQ-1, thermal package for electronic gear, and two ballast boxes. (C)

2. A 24 foot emergency parachute was rigged between the gondola and the balloon to prevent free fall of any portion of the vehicle in the event of balloon failure during ascent. (U)

3. Four packages of chaff were attached to the bar assembly and rigged in such a manner as to be automatically dispersed on bar separation. The purpose was to provide positive fixing of termination position by radar. (C)

4. A radiosonde unit was attached to the system to provide information on level-off altitude if the ascent were successful, or to give a positive indication if failure occurred within approximately two hours of launch. (S)

F. Tactics: Because of the relatively inflexible nature of the balloon system and the fact that maximum altitude had been prescribed, few tactical decisions were necessary. Those found necessary are described briefly below: (S)

1. Based on meteorology, radio transmitter turn on times were established to insure that regardless of wind speed encountered (within reasonable limits) the transmission would begin prior to arrival of the balloon in the recovery area. (S)

2. Camera turn on times were to be delayed long enough in each case to avoid the possibility of photographing friendly territory. (S)

3. The 66CT balloons were to be launched from the two German sites so as to penetrate the border during hours of darkness. The 128TT was not restricted as to hours of darkness, nor was the 66CT when launched from the other three sites. (S)

4. To obtain sufficient balloon life expectancy (7-8 days) and stay within the prescribed altitude ceiling, the 66CT balloons were prepared for a planned initial altitude of approximately 46,500 feet and a ballasting altitude of 40,000 feet; 128TT balloons were prepared for an initial altitude of 50,000 feet and a ballasting altitude of 45,000 feet. (S)

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V. OPERATIONAL PHASE, PRIMARY MISSION:

A. General: By 1 December 1955, the established date for commencement of operation, all units were in place and operationally ready. Pending receipt of an execution order command post exercises, Moby Dick Far East, and other training in mission accomplishment continued. Also advantage was taken of this period to continue the distribution of additional production material to the overseas locations. (C)

1. The mission was ordered executed on 10 January 1956. Eight effective balloons were launched on that date. (S)

B. Launching:

1. Subsequently, balloons were launched daily at rates consistent with the directed limitations except as further limited by political considerations and surface weather. Launch teams of the 1110th Air Support Group turned in exceptional performances, demonstrating on some occasions capability to exceed the maximum launch rate programmed. (S)

2. The limitation to 10 effective launches per day continued in effect until 17 January when it was increased to 20 per day. On 25 January it was increased to 30 per day; and to 40 per day on 28 January. (S)

3. Although experiencing their worst winter weather for several years at the launch sites, pre-mission predictions of percentage of weather favorable for launch were found to be quite accurate. As expected, from standpoint of surface weather, [Evanton] was the poorest site and [Adana] the best. The original concept in regard to weather was that balloons could not be launched in the presence of any precipitation, fog, or icing. Because such restriction would have an adverse effect on capability to meet daily quotas, it was decided to test feasibility of launching under these conditions. From these tests it was concluded that balloons can be successfully launched during periods of fog and light precipitation in the absence of severe icing conditions. Weather criteria for launch were changed accordingly. (TS)

4. [Due to reasons unknown to 1st Air Division, the British administration had failed to notify the Air Ministry that operations at Evanton were authorized. For this reason, no launches from Evanton could be made until late on 11 January 1956, when approval to launch was granted. Again, on 4 February 1956, the British Government, through the Air Ministry, requested that launches at Evanton be restricted to only those which would not overfly East Germany. It was estimated that this restriction would prevent launch]

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approximately 25% of the time, which, when coupled with unfavorable ground weather and unfavorable upper air trajectory, practically eliminated Evanton as a productive launch site. (TS)]

5. [Operations from the two launch detachments in Germany were suspended for 36 hours on 23 January 1956, due to a formal protest to ICAO by Czechoslovakian CAA claiming that the balloon program constituted a hazard to air navigation and as a consequence had grounded all night flights of Czech airlines. CINCUSAFE, through the German ATC notified Czechoslovakia that balloon operations from Germany would be suspended for 36 hours pending Czech presentation by documented evidence that the balloons were in fact flying at altitudes where they constituted a hazard to air navigation. Launchings from the two German sites were resumed after a 36 hour stand-down. (C)]

6. [Balloon launchings at Gardermoen, Norway, were suspended at the request of the Norwegian government on 18 January 1956. This request was based on (1) Swedish protest of balloons constituting a hazard to air navigation, (2) "free falling objects" reported from the vicinity of the launch site, (3) the injury of a Norwegian boy by the explosion of a squib on a downed gondola. Approval to resume operations at Gardermoen was granted on 31 January 1956 after lengthy investigations into failure cause factors.] Launches were permitted only under conditions most favorable to successful ascent and flight. Launch operations were resumed on 3 February when the required conditions existed. [Because of poor trajectories and surface weather at Gardermoen during the first week of operation, and the requirement to stand down for two weeks for political reasons, only a token number of balloons were launched from that site. (TS)]

C. Tracking: Tracking detachments obtained 22,867 bearings which were used in plotting balloon positions during the operation. This does not include the many single bearings which were obtained on transmissions from balloons which were heard at least one time, since such bearings could not be used for position fixing. Often only an initial transmission would be received, after which the balloon was not heard from again; further, some of the initial transmissions were termination signals which indicated loss, either by a system failure or unfriendly countermeasures. A deficiency was noted in the tracking capability over the Bering Sea and Northwestern Alaskan area. To offset the deficiency, a detachment was formed from in-place resources and located at Nome. The detachment became operational after termination of the operations; as a result, it did not contribute to the mission. [In addition, a survey of Formosa was conducted with a view to determining feasibility of operating a tracking detachment from that location should it be required. (TS)]

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D. Recovery: Recovery activity functioned smoothly and effectively. With few known exceptions balloons were tracked prior to arrival and were terminated. As expected, arrivals occurred at night and during adverse as well as good weather. The average speed of travel in the recovery area was close to 100K. The requirement for ground cut-down stations was fully justified under these conditions because it was necessary to terminate 14 balloon flights by this method. Thirty seven were terminated by aircraft, several expired normally in the recovery area, and one was terminated by a friendly fighter. Due to weather and other operational considerations, the C-119 aircraft had an opportunity to recover only 19 gondolas from the air and were successful in 16 attempts. (TS)

1. Surface recovery support in the FEAF area was a source of great satisfaction. The 3d Air Rescue Group did a fine job in both locating and recovering downed packages. To date a total of 28 packages have been recovered through all agencies participating in the surface recovery support plan. (TS),

2. Procedures established for the return of recovered gondolas to the ZI via MATS after collection and processing by FEAF were very effective. The average time required for delivery [from Tokyo] to the 15th Reconnaissance Technical Squadron at March Air Force Base was 75 hours. (C)

E. Major Problems:

1. The UHF locator beacon failed to operate on the first few systems which terminated in the sea in the recovery area. This led to a series of tests, both by the manufacturer on recovered beacons, and at launch sites by launch personnel to determine cause factors. Those returned to the manufacturer from the recovery area were found to work unless too badly damaged. Aside from occasional equipment breakage in launch, no reason for beacon failure could be determined, and it was concluded that the fault was in the floating attitude of the gondola to which it was attached. Unless it floated so that the battery was under water, the battery would not be activated. Action was taken to correct the floating position to insure best chances for beacon operation. (S)

2. The water station, although it had never been fully tested and proven, was rigged for operation on all of the initial flights; however, since the locator beacon did not function on the first few gondolas which went down in the water, these gondolas were not located by project aircraft and there was no opportunity to use the water station. On those which were picked up by boat there was no indication that the water station had erected. Soon after

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commencement of operations, a friendly national was injured while tampering with the water station activation squib found on the gondola of a balloon which had failed in the launch area. Subsequently, the squib was removed as a hazard, and this rendered the water station incapable of operation. However, it was necessary to continue attaching it to the gondola because its weight was needed to cause the gondola to float with the beacon battery under water. Development of a means to insure proper floating attitude without this piece of equipment was initiated immediately since it was thought that complete removal of the water station would reduce radar sighting capability. At time of suspension of operations a suitable method had been devised and tested, but it was never used. (S)

3. An analysis of balloon profiles taken from data recorded by recovered gondolas disclosed two significant factors. First, balloons were not approximating their estimated life expectancy. Instead of expending ballast equal to 7% of gross load per day, the average expenditure was about 10%, reducing life expectancy from 7-8 days to 4-5. It appeared that atmospheric disturbances caused variations in floating altitude that resulted in two, and sometimes three, ballasting periods during 24 hours rather than the one ballasting period expected. The necessarily narrow spread (5-6000 ft) between initial altitude and ballasting altitude is thought to be contributory to this phenomenon. Secondly, it was found that balloons spent considerably more time at the ballasting altitude than was anticipated. It was thought that with sunrise the balloon would make a fairly rapid ascent to its maximum altitude, and that it would remain there until late afternoon when it would descend because of cooling. Thus, for most of the day it would be high enough to reduce vulnerability to a minimum. Periods of greatest vulnerability would be early morning and late afternoon. This was found not to be the case. Although it rose rapidly in early morning, it began to cool and descend very shortly after noon, arriving at ballasting altitude with several hours of daylight left; and of course was most vulnerable during that time. Undoubtedly, there is a close relationship between this phenomenon and the one previously discussed in regard to over-ballasting. Both factors significantly reduced the chances of any balloon to successfully make the trip to the recovery area, either because of reduced normal life or increased vulnerability. Both were, however, operationally inescapable within the range of altitude to which flight was limited by directive. (TS)

4. As previously stated, at the start of operations 1st Air Division had approximately 1300 L28TT balloons and 1500 of the 66CT type. To get an early indication of which type would be most effective operationally, both types were launched in approximately equal numbers at the beginning of operations. Moby Dick Hi results had indicated

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that the 128TT ascent success rate to be expected would vary from about 80% success with higher serial numbers, to 50% with lower serial numbers; the break point being at or near serial number 1000. In order to pin down within the number of 128TT balloons available a point below which the failure rate would be excessive, it was decided to launch in serial number blocks of 100, starting from the highest numbered balloons and launching in numerical progression downward at each site, except that [at Evanton and Giebelstadt] a test quantity of low serial numbered balloons would be launched to determine if failure rate confirmed the Moby Dick Hi findings. After several days of operation, the ascent success rate of the lower serial numbers was found to be 47% as compared to 83% for the higher serial numbers. A decision was then made that all 128TT balloons with serial numbers lower than 950 would be set aside and not used. This resulted in a reduction of the useable balloon inventory by approximately 700 balloons and left a deficit of 500 which would be required if the mission objective of launching 2500 was to be achieved. To eliminate this deficit, a requirement was stated for delivery by 1 March of balloons of a new type which would combine the strength of the 66CT and approach the altitude capabilities of the 128TT, at the same time providing more operational flexibility. Such a balloon was designed (the 83CT) and a few were test flown by AFCRC. Procurement was on schedule for delivery in March 1956, but was halted when operations were suspended and none were ever delivered. (S)

5. Since the decision to set aside the low numbered 128TT balloons left only a limited number in the inventory, it was decided to conserve these for a later period when their use might be mandatory to avoid attrition by flying at higher altitudes. (The 66CT was not capable of use at higher altitudes without drastic reduction in life expectancy). Accordingly, only 66CT balloons were launched beginning 22 January 1956. (TS)

6. By 3 February 1956 it became apparent that attrition was unacceptably high at the lower altitudes and 128TT launchings were resumed using slightly higher altitudes than previously (54,000 ft initial floating altitudes; 50,000 ft ballasting altitude). This was maximum possible altitude under the existing directives, and Headquarters USAF was asked to raise the ceiling to a minimum of 60,000 ft, or to eliminate it entirely. (TS)

F. Suspension of Operation: On 6 February stand-down of all launches was directed. (C)

1. An appraisal of the situation at this time indicated that one of two courses of action should be followed in the event resumption of operations was authorized. One was to launch all

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usable balloons (including the supplementary 83CT's) at maximum rate possible and at maximum altitude. The objective would be to saturate or avoid defenses and end the mission on the earliest date possible. Capability to complete entire mission by mid-April existed if operations were resumed prior to 15 February. The alternative was to continue only with the remaining 400 high serial number 128TT balloons which could possibly be flown above defenses. To increase the difficulty of detection, water stations would be removed and the maximum altitude would be flown. Through these measures it was thought that the operation might attract less attention and thus be acceptable. These proposals were made to Headquarters USAF on 9 February 1956. (TS)

2. Headquarters USAF favored the alternate proposal (launch only the 400 128TT balloons) if operations were to be resumed, but removed altitude restrictions entirely for only 10% of the number. The remaining 90% were limited to a maximum of 58,000 ft. On 24 February, Headquarters USAF advised that a proposal for resumption of operations under these ground rules at the earliest possible date had been sent to the Secretary of the Air Force. (TS)

G. Termination of Operational Phase:

1. Informally on 29 February and by message on 1 March 1956, USAF directed termination of the operational phase of the project, except that search for and recovery of unaccounted for gondolas would continue. (S)

2. By Headquarters USAF directive, 1st Air Division and Strategic Air Command relinquished operational control of operational units to parent commanders on 26 March 1956. (Redeployment of these units and disposition of surplus materiel became a responsibility of the parent commands and Air Materiel Command.) (C)

VI RESULTS:

A. During the operational period, 516 balloon systems were launched. Of these systems 399 were considered to be operational; there were 117 known failures, and 12 of those considered operational were later recovered from friendly areas without having entered the target area. Of the remaining 387 operational balloons, 144 were later heard to transmit, of which 123 were tracked, and 21 were termination signals heard as the first transmission; 243 were never heard from after launch. Of the 123 which were tracked, only 67 entered the recovery area. 57 of these were terminated and 44 of them had been returned as of 5 March 1956. Of the 13 which were terminated but not recovered, 4 have terminal positions on land, 9 in the sea (7 Pacific, 2 in Sea of Japan). The 10 which arrived but were not terminated are presumed to be down in the Pacific or in the Polar regions. Although termination was attempted on 6 of these, all attempts were unsuccessful, presumably because of failure of balloon electronic gear to

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respond. Four entered the recovery area only by definition, since they were too far to the north for interception. (TS)

B. Fifty-eight balloons heard to transmit, were tracked, but never arrived. These were functioning systems and from all indications most of them should have been blown into the recovery area. However, the vast majority of them ceased their transmission prior to their seventh day of life. One cluster of eighteen balloons was being tracked across the North China area heading directly for Japan, - only three actually arrived and nothing more was heard from the remainder. There are several possible causes. Electronic malfunction could have resulted in cessation of transmissions; over-ballasting, as previously discussed, could have resulted in premature flight termination behind the lines; they could have been terminated by enemy action; or their trajectories may have been such as to carry them beyond listening range. (TS)

C. Two hundred forty three balloons were never heard from after launch. This means that they were either travelling in the wrong direction completely; they experienced complete failure of the HF transmitter; or they failed to live until their programmed turn-on time. Since many of these balloons were launched close in time to balloons which later arrived, trajectory is thought to be responsible for only a small percentage. From Moby Dick Hi statistics it was reasonable to assume that 85% of the transmitters would function properly. This leaves the vast majority in the category of not having lived long enough to transmit. It is reasonable to assume that some launches which were considered successes, in actuality were not. Perhaps the launch personnel were unable to monitor the flight long enough to observe failure; perhaps minute holes were in the balloon allowing the gas to leak out over a period of hours; perhaps the ballasting mechanism failed and caused the balloon to descend to the ground. Although over-ballasting is known to have shortened balloon life to a degree, this degree was not such that a large number would expire for this reason prior to turn-on time. Although no exact values can be placed on any of the above factors; even in combination, it is considered unreasonable that they could have been responsible for early termination of such a large number of balloons. It is concluded, then, that the major contributing factor to loss of these balloons was attrition by enemy action. This conclusion is strengthened by the fact that, enjoying the element of surprise, balloons launched prior to 26 January were fairly successful; however, of 184 balloons successfully launched on and after 26 January only 28 were heard to transmit and only two were recovered. This indicates that after two weeks in which to react, the USSR had come up with an exceptionally effective defense. Contrary to the radar tracking capability demonstrated in the ZI during Moby Dick Hi, 12th Air Force radars were able to track balloons

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up to 150 miles across the line; it is assumed, therefore, that Russian radars were similarly capable. The length of the metal cross-bars and the metal water station increased radar vulnerability. It was known beforehand that Russian fighters were capable of attaining the altitudes to which the balloon flights were restricted (55,000 ft). Vulnerability was certainly affected by balloon behavior, as previously discussed, in descending to ballasting altitude (40,000 to 45,000 ft) shortly after noon. (TS)

1. As the effect of attrition became noticeable, such steps as were possible were taken to minimize the vulnerability. Altitude was increased to the limit possible within the directed ceiling and radio turn-on times were delayed to deny use of these signals as an aid to the enemy. Plans were made to remove the water station entirely, in order to minimize radar detection; removal or raising of altitude restrictions was recommended to USAF; balloon transmitters were not to be turned on until the very last day of programmed life. Operations were suspended before all of these measures could be placed into effect. (TS)

D. All systems launched carried the DMQ-1 (photographic) gondola. No DMQ-2 (electronic ferret) packages were launched since this type of equipment was not perfected in time. (TS)

E. A summary of photographic accomplishments processed by the Aeronautical Chart and Information Service as of 30 March 1956, is as follows:

1. Total number of missions from which photography was obtained - 40. (TS)

2. Total number of usable exposures - 13,813. (S)

3. Gross statute miles of charting photography - 1,984,173. (S)

4. Net statute miles of charting photography - 1,661,869. (equal to approximately 51% of the Continental United States) (S)

5. Gross square statute miles of charting photography for Sino-Soviet area - 1,388,745. (TS)

6. Net square statute miles of charting photography for Sino-Soviet area - 1,116,449 - (equal to 37% of the Continental United States, or approximately 8% of Sino-Soviet area). (TS)

7. Cost per square mile (net) \$48.49. (U)

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TAB A

CONCLUSIONS

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I. CONCLUSIONS: It is concluded that:

- A. Weapons System 119L was a reasonably effective means of obtaining pioneer reconnaissance at comparatively small cost. (TS)
- B. The predicted upper air trajectories over the USSR and its satellites was as accurate as could be expected. (TS)
- C. The delay in commencing the operation (from 1 December 1955 to 10 January 1956) compressed the project, time-wise, to within a very short period of favorable winds. However, the operation could have been completed (2500 launches) by 1 May 1956, if project had been permitted to continue. (S)
- D. The element of surprise contributed appreciably to the successful results obtained during the initial days of the operation. (C)
- E. Vulnerability to unfriendly countermeasures and overballasting were the two factors contributing most to failure to transit the target area. (TS)
- F. Ground termination stations are a mandatory back-up for other recovery techniques. (S)
- G. Deficient polyethylene and manufacturing defects caused a deficit of approximately 700 balloons in the operational inventory. (C)
- H. The type of photography obtained affords an excellent source for pioneer reconnaissance, but due to limiting factors, detailed analysis of new intelligence is difficult. (See Tab "J", Chapter III) (S)
- I. The findings of the Moby Dick Hi vulnerability tests, involving the Air Defense Command, were misleading. Since 12th Air Force radars (MSQ-2) were capable of tracking balloons at high altitude and at ranges up to 150 nautical miles, it is concluded that Soviet radars have similar capability; therefore, in design of any future system for this purpose, care should be taken to minimize radar reflective surfaces and materials. (TS)
- J. More specific knowledge of balloon performance must be obtained, and design influenced thereby, in order to obtain everything possible from this weapons system. (C)

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K. The C-119 aircraft:

1. Is useful to perform air-to-air electronic cut-down, however, this could be accomplished by several other aircraft types. (S)
2. Is too slow to overtake the balloon due to approximately equal groundspeeds of the balloon and aircraft under certain jet stream conditions. Success was assured only when the aircraft could assume a position ahead of the balloon. (C)
3. Air-to-air recovery capability was dependent upon the existence of daylight and VFR conditions. (S)

L. Surface recovery of all packages should be planned as the primary method of recovery with a suitable and fool-proof method of locating the package, such as a beacon capable of operating on land and water. (S)

M. Due to excessive ballast rates, duration was marginal. The reconstructed profiles indicate that the life expectancy is somewhat shorter than the theoretical average of 7 and 8 days for the 66CT and 128TT respectively. See Tab "N", Chapter III. (C)

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CHAPTER II

PRE-PRIMARY MISSION ACTIVITIES

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PART I

DEPLOYMENT

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I. DEPLOYMENT: This part is subdivided into three major paragraphs for presentation of information pertaining to the deployment of 1st Air Division subordinate units. Paragraph A contains comments applicable to the overall deployment, paragraph B contains information pertinent to each subordinate unit and paragraph C contains general supporting information (See Inclosure 1 this Part for graphic presentation of deployment) (C)

A. General Comments:

1. Operational units of 1st Air Division were deployed to three major geographical areas. Detachment 1, 1st Air Division and the 1110th Air Support Group, providing the launch capability, were deployed to the European area. Units of the 6926th Radio Squadron (Mobile) and 456th Troop Carrier Wing (M), providing the tracking and recovery capability, were deployed to two areas: the Far East and Alaska. (See paragraph C for Force Distribution.) (S)

2. Initially, planning to transport personnel and equipment for the 1 November 1955 implementation date dictated the need for airlift of all personnel of the 1110th Air Support Group and the 456th Troop Carrier Wing, and the majority of the 456th Troop Carrier Wing equipment, which was required in the Zone of Interior to complete operational training. This posed a major problem in that, during the scheduled deployment period, the Air Force was supporting Army world wide troop movements, such as Sage Brush, and airlift was not available for the timely deployment for an operation of this magnitude. The problem was primarily resolved by the non-operational status of the 119L Weapons System which delayed the project "go-date" to 1 December 1955. This interim period was used to continue operational training for applicable units to the extent that certain equipment and personnel could be released for surface shipment to forward locations. With this added time, a revised deployment program, including transportation requirements, was finalized in Headquarters United States Air Force conference on 9 August 1955. Detachment 1, 1st Air Division, being a small force of 10 officers and 3 airmen, activated from Headquarters 1st Air Division, were transported to their forward location by 1st Air Division aircraft on 30 June 1955. Deployment of the 6926th Radio Squadron (Mobile) was handled on a PCS basis by United States Air Force Security Service through routine shipping channels and offered no particular problem. (S)

3. The final stage of unit deployment was effected with United States Air Forces in Europe, Far East and Alaskan Theater Air Commanders as applicable. This stage provided for

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the transport of personnel and equipment from ports of debarkation to the operational sites. The wide-spread operation within each geographical area and the close schedule for in-place dates of units required theater airlift in many instances. This mammoth task was readily and efficiently accomplished in all theaters. Evaluation of this basic deployment of personnel and equipment revealed that no operational delays were experienced through lack of transportation supporting the deployment. (U)

4. A recovery unit was originally scheduled for Iwo Jima; however, typhoon "Louise" destroyed all operational facilities on Iwo Jima and the decision was made to move the recovery unit to Itazuke, Japan. The base at Itazuke was prepared in a minimum length of time and no delay in the operational capability was experienced. (S)

B. Detailed Deployment Information:

1. Detachment 1 - 1st Air Division: This unit, consisting of 10 officers and 3 airmen, was activated through Strategic Air Command resources on an as required basis. Initial increment of Detachment 1 personnel departed for the European area on 30 June 1955 with a 1st Air Division Survey Team. Purpose of this survey visit was for United States Air Forces in Europe, 1st Air Division and Detachment 1, 1st Air Division to conduct on the spot coordination of launch sites and promote a thorough understanding of requirements and anticipated problem areas. After completing the survey, Detachment 1, 1st Air Division personnel established a command post at High Wycombe, England, on 28 July 1955. (S)

2. 1110th Air Support Group:

a. Authority for deployment of the 1110th Air Support Group, was contained in Headquarters Command Movement Order, 1110th Air Support Group, 23 June 1955, as supplemented by 1st Air Division Operations Order 227-55, 31 August 1955.

b. In planning the deployment of the 1110th Air Support Group, consideration was given to providing the maximum training time possible in the Zone of Interior, yet insure that the organization was in place at operating locations 30 days prior to the project implementation date. Establishing 1 November 1955 as the in-place date, a phased deployment of personnel and equipment was programmed. By deploying small increments of selected personnel and certain equipment to each site at an early date it was possible to retain the main body of the 1110th Air Support Group in the Zone of Interior

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for a longer period of operational training than originally anticipated. In support of this plan the phased deployment of personnel and equipment was accomplished as follows: (C)

(1) Personnel:

Phase	Identification	Number Personnel	Cargo	Depart Z.I.	Mode	Arrive Operating Area
I.	Preparatory Echelon	5 Officer 4 Airmen		30 Jun 1955	A/L	28 July 1955
II.	Advanced Echelon	4 Officer 88 Airmen	93,000#	18 Aug 1955	A/L	23-30 Aug 1955
III.	Main Body and UME	43 Officers 569 Airmen 30 Civilians	384,000#	5 Oct 1955	Sur-face	1 Nov 1955

Note 1: Representatives for each launch site were included in each phase.

Note 2: Cargo for Phase II includes 67,000 pounds for advanced echelon plus special test and teletypewriter equipment of 25,800 pounds.

Note 3: Civilians indicated were Technical Representatives.

Note 4: Preparatory echelon accompanied 1st Air Division staff on site survey and returned to High Wycombe, England, to establish an 1110th Air Support Group Command Post adjacent to Detachment 1, 1st Air Division. (C)

(2) Equipment:

Phase	Identification	Amount	Depart ZI	Mode	Arrive Destination
I.	Grand Union	27,000,000#	1 Aug 55	Sur-face	15 Oct 55
II.	Homing Beacons	75,000#	1 Dec 55	A/L	3 Dec 55

Note 1: Grand Union equipment was shipped by Air Materiel Command.

Note 2: Homing Beacons were procured late in the program and shipped by 1st Air Division as separate items. (C)

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c. Intra-theater deployment of launch units to operational sites was accomplished as scheduled with exception of Detachment 3. Due to political implications certain restrictions were imposed by Norwegian officials. It was determined that: (1) total United States Air Force military and civilian personnel would not exceed 100; (2) that a roster, indicating individual names, would be provided three weeks prior to arrival of the unit and (3) for security purposes, Detachment 3 would be deployed to Norway on 3d Air Force Headquarters orders. The problem encountered, due to Norwegian restrictions, was the reduction of detachment strength from 128 to 100. Negotiations provided for a workable solution by (4) Norway providing qualified civilian replacements for the 28 personnel reduction or (5) if qualified civilian replacements would not be provided then United States Air Force total personnel complement could be increased as applicable for operational support. Coordination for resolving these restrictions delayed the intra-theater deployment for Detachment 3 for approximately two weeks. However, Detachment 3 arrived in time to meet a 1 December 1955 operational ready status. During conduct of the operation the lack of certain qualified Norwegian civilians raised the United States Air Force personnel total to 103. (TS)

d. In total, the 1110th Air Support Group deployed 743 personnel and 477,000 pounds of equipment with an additional 27,075,000 pounds of equipment being deployed by Air Materiel Command. The personnel total consisted of 52 officers, 661 airmen and 30 civilian Technical Representatives. (U)

3. 456th Troop Carrier Wing (M):

a. Authority for deployment of the 456th Troop Carrier Wing (M) was contained in 18th Air Force Movement Order 456th Troop Carrier Wing, 23 June 1955, as supplemented by 1st Air Division Operations Order 226-55, 1 September 1955 and 456th Troop Carrier Wing Operations Order 1-55, 22 August 1955. (C)

.. As indicated for the 1110th Air Support Group, operational training time in the **Zone of Interior** was at a premium. To provide maximum training time it was decided to waive the requirement for recovery units to be in place 30 days prior to implementation date of the project. This decision was influenced by: (C)

- (1) Completing training in the Zone of Interior and standing down for aircraft maintenance, the 456th Troop Carrier Wing would be operational on arrival at forward location. (U)

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- (2) Operational activities would not commence until "go-date" plus travel time of the balloons to recovery area. (C)
- (3) Less problems were anticipated in shake down period after unit arrival. (U)

With above in mind, 20 November 1955 was established as the in-place date to become operationally ready. In support of this date, a phased deployment of personnel and equipment was accomplished as follows: (U)

(1) Personnel:

<u>Phase</u>	<u>Identifi- cation</u>	<u>Number of Personnel</u>	<u>Number of Unit Acft</u>	<u>Cargo</u>	<u>Depart ZI</u>	<u>Mode</u>	<u>Arrive</u>
I	Advanced Echelon	143	1	88,147#	2-10 Aug	A/L	8-22 Aug
II	Main Body	1217		320,250#	5 Oct to 12 Nov 55	Sur- face	12 Oct to 20 Nov 55
III	Tactical Acft and Crews	349	49	0	1-15 Nov	A/L	4 to 20 Nov
IV	Rear Echelon	49		26,000#	20 Nov	A/L	1 Dec 1955

Note 1: A period of days shown for departure or arrival indicates first and last day personnel of that phase departed or arrived. (C)

(2) Equipment:

<u>Phase</u>	<u>Identifi- cation</u>	<u>Amount</u>	<u>Depart ZI</u>	<u>Mode</u>	<u>Arrive Destination</u>
I	Flyaway Kits	733,916#	15 Sep 55	Surface	1 Nov 55
II	Power Packs	342,000#	1 Sep 55	Surface	2 per mo
III	Propellers	72,000#	1 Sep 55	Surface	1 Nov 55
IV	UME	1,168,997#	15 Sep 55	Surface	1 Nov 55 (U)

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c. In planning for maintenance support of the tactical aircraft movement, the main body of the 456th Troop Carrier Wing was subdivided into three increments. Two of these increments comprised the maintenance capability. This maintenance unit accomplished the required inspection for aircraft deployment during the first part of October 1955. On 26 October 1955, one increment of the maintenance unit deployed by surface to Adak and Kodiak, Alaska, to provide enroute maintenance for tactical aircraft as required. The remaining increment performed maintenance support at the home station until all tactical aircraft departed. This unit was deployed with the rear echelon by Tactical Air Command C-124 aircraft. The remaining increment comprising a majority of the main body deployed by surface shipment departing Zone of Interior home station on or about 5 October 1955. (C)

d. In total, the 456th Troop Carrier Wing deployed 1763 personnel and 2,751,290 pounds of equipment. The personnel total consisted of 289 officers, 1459 airmen and 15 civilian Technical Representatives. (C)

4. 6926th Radio Squadron Mobile:

a. United States Air Force Security Service retained responsibility for deployment of the 6926th Radio Squadron Mobile. Their purpose was to deploy personnel on PCS status with the view of integrating personnel in United States Air Force Security Service organizations, as applicable, on completion of the operation. Specialized equipment was also handled by Security Service. Headquarters 1st Air Division assisted United States Air Force Security Service where possible in the deployment of personnel and equipment. (C)

b. Deployment of personnel and equipment was accomplished as scheduled with the exception of 35 communications specialists. 15 of these 35 specialists were provided on 15 August and the remainder on 1 September 1955. In addition, certain items of equipment scheduled for in-place date of 20 July 1955 did not arrive until 1 September 1955. (U)

c. Overall, the delay of specialist personnel and items of equipment did not preclude United States Air Force Security Service from attaining an operational ready status as scheduled on 1 September 1955, although some D/F sites were on a limited operational capability until arrival of personnel and equipment. (C)

d. In total, United States Air Force Security Service deployed 725 personnel and 1,280,000 pounds of equipment. The personnel total consisted of 30 officers, 685 airmen

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and 10 civilian Technical Representatives. (U)

C. Force Distribution:

<u>Organization</u>	<u>Auth Strength</u>				<u>Location</u>
	<u>Officers</u>	<u>Airmen</u>	<u>Civilians</u>	<u>No Acft</u>	
1. Hq 1AD (MS)	40	62	6	3	Offutt AFB, Nebr. (U)
2. Det 1, 1AD (MS)	*10	3	1	**1	High Wycombe, RAF Station, England. (C)
* Only six (6) officers and three (3) airmen were assigned for initial operation. The other positions were filled on an as required basis.					
**C-47 aircraft based on Bovington, England.					
3. Hq - 1110th ASG	17	68	2	*1	High Wycombe, RAF, England
Det 1	7	119	6		Oberpfaffen- hofen, Germany
Det 2	7	119	6		Adana Air Base, Turkey
Det 3	7	116	5		**Gardermoen RNAF Sta, Norway
Det 4	7	119	5		Evanton RAF Sta, Scotland
Det 5	5	120	6		Giebelstadt, Germany
Total	52	661	30		***Bucke burg, Germany (TS)

* C-47 aircraft based at Bovington, England. (U)

** 100 United States personnel ceiling imposed by Norway. (95 United States military personnel and 5 civilian technical representatives, which was ultimately raised to 106 total because of mission requirements.) Remaining 22 United States Air Force military personnel of Detachment 3 were assigned within 1110th Air Support Group units. (TS)

***Alternate launch site. (U)

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<u>Organization</u>	<u>Auth Strength</u>				<u>Location</u>
	<u>Officers</u>	<u>Airmen</u>	<u>Civilians</u>	<u>No. Aft</u>	
4. Recovery:					
Hq - 456th TCW	28	59 *5	3	***1	Shiroi AB, Japan
744th TCS	44	209 *5	2	8	Kadena AB, Okinawa
745th TCS	44	267 *5	2	8	Adak NAS, Alaska
746th TCS	44	267 *5	2	8	Kodiak NAS, Alaska
744-1 TCS	44	209 *5	2	8	Itazuke, Japan
745-1 TCS	44	209 *5	2	8	Miwake AB, Japan
746-1 TCS	41	209	2	9	Johnson AB, Japan
Total	289	1429 50	15	50	***Midway Island, Clark AFB, P.I. (S)

* Airmen TDY to 456th Troop Carrier Wing from Strategic Air Command. (C)

** Aircraft based at Johnson Air Base, Japan. (U)

***Alternate Recovery Bases. (C)

5. Tracking:

Hq - 6926th RSM	10	160			Shiroi AB, Japan
Det 1	2	49	1		Shiroi AB, Japan
Det 2	2	54	1		North West Flt, Guam
Det 3	2	50	1		Wake Island
Det 4	2	54	1		Clark AFB, P.I.

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<u>Organization</u>	<u>Auth Strength</u>			<u>Location</u>
	<u>Officers</u>	<u>Airmen</u>	<u>Civilians</u>	
Det 5	2	54	1	Yontan AB, Okinawa
Det 6	2	54	1	Pyongtaek, Korea
Det 7	2	54	1	Chitose AB, Japan
Det 8	2	50	1	Midway Island
Det 9	2	55	1	Shemya AFB, Alaska
Det 10	2	51	1	*Elmendorf AFB, Alaska
	—	—	—	
Total	30	635	10	(C)

* 1 officer and 19 airmen withdrawn for activation of the HF/DF site at Nome, Alaska. (C)

D. Conclusion:

1. The controlled utilization of Military Air Transport Service overseas airlift capability precluded aerial deployment of the major portion of personnel. The result was that Zone of Interior training and preparation was compressed time-wise to meet surface port calls. Early expression of airlift requirements apparently had no effect on the long range projection of airlift utilization (the requirement was stated in May for deployment in October). The situation was further complicated by a delay in designation of the means of deployment transportation resulting in extraordinary efforts by support and deploying units to meet deadline dates. (U)

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MASTER SCHEDULE

		PERS	CARGO	MOBY DICK-HI TRNG		DEPLOY		GO →
				AUG	SEP	OCT	NOV	
456 th TCW	ADVANCED ECHELON	148	88,147	22				
	MAIN BODY	S 931 S 114 A 172	S 134,250 S 62,000 A 124,000			5	19 26	12 20
	TACTICAL AIRCRAFT	349	0				20	
	WNG & SQ REAR ECH	49	26,000				25	
	FLYAWAY KITS	0	733,916		15			
	POWER PACKS	0	342,000		2/SITE			
	PROPELLERS	0	72,000					
	U M E	0	1,168,997		15			
1110 th ASG	ADVANCED ECH & EQUIP	92	67,700	20				
	TEST EQUIP & TELETYPEWRITERS	0	25,362	20				
	MAIN BODY	642	384,000			10		
	GRAND UNION (to include test equip)	0	27,000,000			5		
	MARKER BEACON	0	75,000		500/MO			
6926 th RSM	PERSONNEL & EQUIP	725	1,280,000	READINESS DATE - 1 SEP				
1110 th MDE	LAUNCH TEAMS	A 9 S 9	37,000	7	2			
	TEST PERS & EQUIP	8	4,000		1	5		
	FOLLOW ON EQUIPMENT	0	A 30,000 S 170,000		15	20	5	
	RETURN TEST PERS & EQUIPMENT	8	4,000			15	20	
	REDEPLOY TEST PERS & EQUIP	5	4,000				10	15
	RETURN LAUNCH TEAMS	18	71,000					26
	REDEPLOY LAUNCH TEAMS	11	0					
FACILITIES	LAUNCH TRACKING and CONTROL CENTER	COMPLETE BY		15 AUG				
	RECOVERY	COMPLETE BY		1 SEP				

TRANSPORTATION SUMMARY

TYPE	IN PLACE		PROGRAMMED		TOTAL	
	PERS	CARGO	PERS	CARGO	PERS	CARGO
AIR	507	728,147#	694	35,562#	1201	1,084,709
SURFACE	372	677,000#	1576	30,142,163#	1948	30,819,163

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NOTE: Det 1, 1AD and preparatory echelon 1110th ASG deployed 30 Jun 55.

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PART II

MOBY DICK FAR EAST

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I. MOBY DICK FAR EAST

A. The Moby Dick Far East program provided tracking training for the 6926th Radio Squadron Mobile and 456th Troop Carrier Wing. Two launch teams and required equipment were deployed by 1st Air Division Operations Order 225-55 dated 2 August 1955. One team was placed at Chitose, Japan, and the other at Kadena, Okinawa. Each team consisted of 13 personnel and 138,000 pounds of materiel. Five of these personnel plus 19,000 pounds of materiel were deployed by surface transport and the remaining personnel were airlifted by Military Air Transport Service (MATS). This initial deployment provided a capability to commence launches at each site on or about 7 September 1955 and continue until approximately 100,000 pounds of equipment per site was received by follow-up surface transportation. (S)

B. After a representative number of launches had been made from Chitose it was determined that more realistic trajectories, therefore better DF training, could be obtained by moving the launch operation to K-6, Korea. This generated surface and air transport requirements which were met within resources available to Far East Air Forces (FEAF). (C)

C. The Moby Dick Far East system consisted of a 37.4 foot diameter polyethylene balloon to which was suspended either a Moby Dick package or a modified 119L gondola. (See inclosures contained in this part). On the first 25 flights launched by each team, the Moby Dick packages were used. An abnormally high number of electronic failures occurred. These were attributed primarily to metallic corrosion of the electro-mechanical control equipment. This corrosion apparently resulted from the humid conditions at the two original launch sites and from inadequate waterproofing of these packages for surface vessel shipment and the subsequent short storage time. Corrosion on the 119L electronic equipment was negligible. The first 25 flights made had the duct of the balloon cut-off so as to lower the altitude to approximately 30,000 feet. Since a high rate of failure was encountered during ascent, the duct was not modified on later flights. With a load of 350 pounds, the system then floated at 39,000 feet. The first launched used the vertical launch method. All remaining launches were accomplished with the "covered wagon" inflation method. The covered wagon appeared to be the most suitable method due to the consistently high surface winds in that area. (See inclosures 2 and 3, this tab). (C)

D. The following is a break-down of equipment which comprised the Moby Dick Far East system: (C)

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1. 124A balloon inflated with 6,000 cubic feet of hydrogen.
2. 24 foot safety chute which doubled as a load strap.
3. Sub-bar from 119L Moby Dick Hi system.
4. Ballast hopper from 119L Moby Dick Hi system.
5. Electronic package from 119L Moby Dick Hi system.
6. 120 pounds of 119L ballast.
7. Hydrogen trailers or individual bottles for hydrogen storage.
8. Launch cart and covered wagon locally manufactured at Lowry AFB, Colorado.

E. Moby Dick Far East was scheduled to terminate on 1 December 1955 so as not to interfere with the primary mission 119L systems that were scheduled to be launched on that date. Due to the delay in the execution of the primary mission, several of the Moby Dick Far East vehicles were held in reserve and provided a continuous, though sporadic, balloon launch capability and training capability in the area until actual execution of the primary mission. 211 of the scheduled 230 Moby Dick Far East vehicles were actually launched with a 98.4 percent launch success rate and average flight duration of 40 hours. An average of 27 position fixes per 24 hour period were obtained on these balloons. Recovery aircraft interceptions were successfully accomplished on 11 of these flights. The final Moby Dick Far East launching took place on 27 December 1955. The remaining Moby Dick Far East balloons handily met the short notice requirement to commence launching additional balloons for the purpose of providing cover for the primary mission. These cover launchings, nicknamed White Cloud, commenced on 9 January 1956 using the Moby Dick Far East equipment remaining. (TS)

F. For the conduct of operations during Moby Dick Far East the following weather service was required and was provided as indicated below: (U)

1. The 1st Weather Wing operating location at Shiroy provided forecasts of surface weather and balloon trajectories to the Recovery Control Center as required for control purposes. (S)

2. The base weather stations at Chitose AB, Kadena AB, and at Pyongtaek (K-6) provided the required forecasts of surface weather conditions for planning and conducting balloon launching operations at those sites. (U)

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3. When the various squadrons and detachments of the 456th Troop Carrier Wing were in place and began practicing intercepts on Moby Dick Far East balloons, forecasts were required for these missions. Weather liaison officers were deployed from the 7th Weather Group for service with the recovery units at Adak and Kodiak where the weather support was provided by U. S. Navy aerological units. Weather liaison officers for recovery bases in the Far East area were assigned from among the weather personnel of the Air Weather Service Detachments at those bases. Supplemental weather support as required at the recovery bases was provided over project communication facilities by the 1st Weather Wing operating location at Shiroy. (S)

G. A Recovery Control Center (RCC) was established at Shiroy AB, Japan to direct, monitor and control all simulated recovery operations. Balloon fixes were passed to the Recovery Control Center where the current position, track and forecast trajectory of each balloon was maintained. The control center staff, based on all known information, directed missions and dispatched recovery crews for intercept. Crews were standing by on 30 minute alert or participating in realistic patrol, intercept and simulated recovery missions. (S)

1. Recovery crews began Moby Dick Far East training on or about 14 November 1955. As each recovery unit arrived at a forward base, they were dispatched on training missions. Units at Kadena, Adak and Kodiak were unable to accomplish desired training on Moby Dick Far East balloons, since the majority of these trajectories were over the northern part of Japan. This was overcome by placing the same 4X equipment in a recovery aircraft as was carried aloft by Moby Dick Far East balloons. The "balloon aircraft" flew a designated route and recovery crews were scrambled on patrol, intercept and simulated recovery missions in the same manner as on Moby Dick Far East balloons. (S)

2. To safeguard recovery aircraft operating on 119L missions in area adjacent to Communist territory, a line was established beyond which recovery aircraft would not operate. This geographical restriction was established at sufficient distance from Communist held territory to avoid "incidents" or inadvertent violation of such territory and, at the same time, did not unduly restrict recovery operations. See Chapter III Tab G, par I, H. (S)

3. Each recovery unit, through the local air traffic control agency in conjunction with adjacent air defense facilities, developed expedited departure routes to be used by recovery aircraft scrambled on recovery missions. Also, procedures were developed whereby recovery aircraft operating on recovery missions in critical areas close to Communist territory, would be kept under continuous

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radar surveillance and advised of current position and track. While operating within these areas, the aircraft commander was required to maintain voice contact with designated Air Defense Radar facilities. (S)

4. Moby Dick Far East training period was used to finalize detailed operating procedures to be used during the primary mission for notifying and monitoring the activities of supporting recovery forces. This was accomplished through the 1st Air Rescue Group, which had been appointed executive agent of Far East Air Forces for this purpose. Although this system was partially exercised by simulations during Moby Dick Far East, the Japanese were not involved for security reasons. (S)

5. Moby Dick Far East statistics are contained on the following page. (U)

H. Cost for the continuous TDY of the Moby Dick Far East personnel was estimated at \$8,100 - funds were provided by Headquarters Command. The cost to Headquarters Command for transportation of 2 hydrogen trailers to the Far East was \$510.00; the transportation for the other 4 hydrogen trailers was provided by AMC. Funding for commercial hydrogen and normal base support was provided by Far East Air Forces. The unit cost of the 124A type balloon was \$180.00.

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MOBY DICK FAR EAST

	September		October		November		December		
	MDFEC*	MDFEK*	MDFEC	MDFEK	MDFEC	MDFEK	MDFEC	MDFEK	TOTAL
No. Launches Attempted	16	6	9	21	72	57	19	11	211
No. Launches Successful	13	6	8	19	70	54	19	11	200
Percent Successful	81.2	100.0	88.9	90.5	97.2	94.7	100.0	100.0	94.8
Average Flight Duration (Hours:Minutes)	19:43	31:52	23:55	32:43	54:00	38:00	29:00	33:00	40:02
Average No. of Position Fixes (Per 24 hour period)	25.2	37.3	28.8	28.6	26.0	30.0	26.0	30.0	27.9
No. "Ghosted" (Inoperative HF)	0	0	4	3	50	22	9	0	88
Interceptions by Recovery Aircraft	N/A	N/A	N/A	N/A	1	2	5	3	11

*MDFEC (Moby Dick Far East Chitose) - Launched from Chitose or K-6.

*MDFEK (Moby Dick Far East Kadena) - Launched from Kadena.

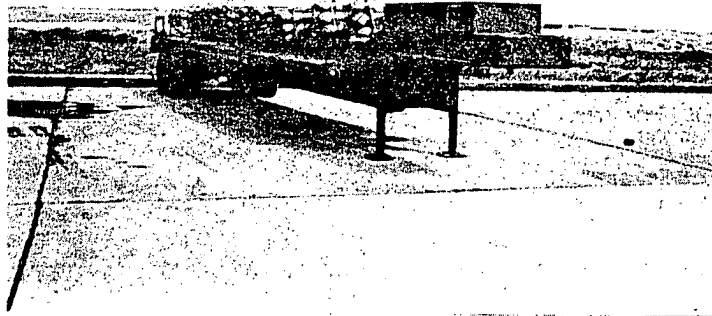
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MDFE Substitute for Hydrogen Trailer



MDFE Covered Wagon Inflation

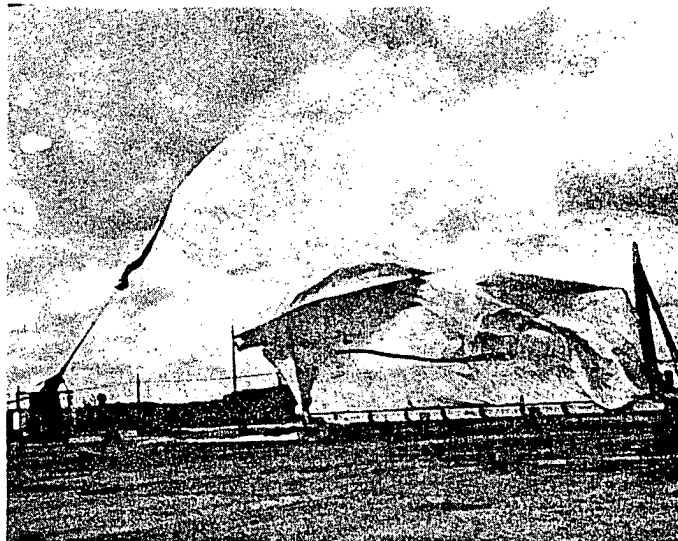
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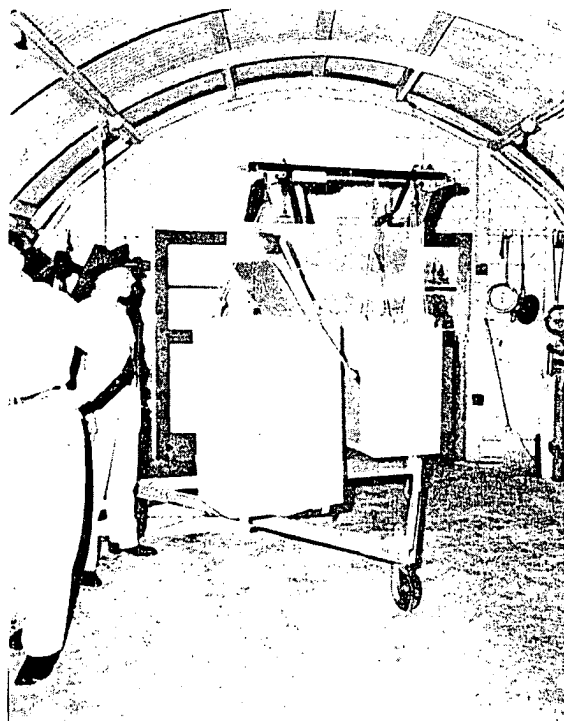
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MDFE Covered Wagon Launch



MDFE Gondola

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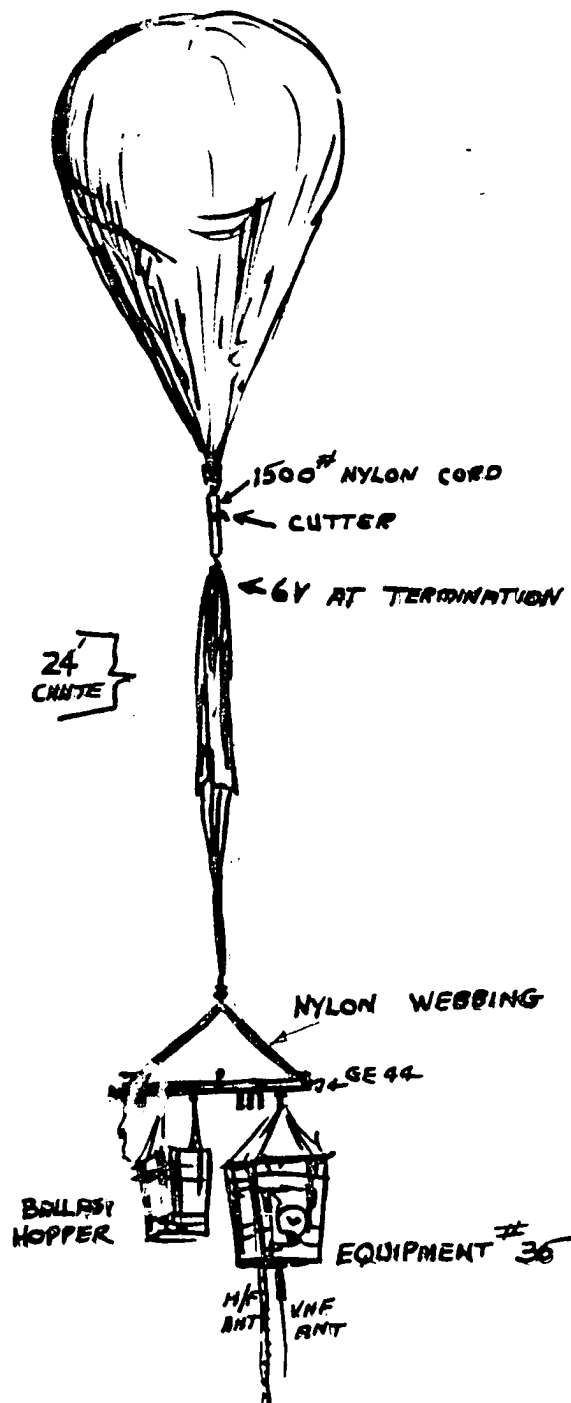
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MOBY DICK
FAR EAST



MDFE Complete System

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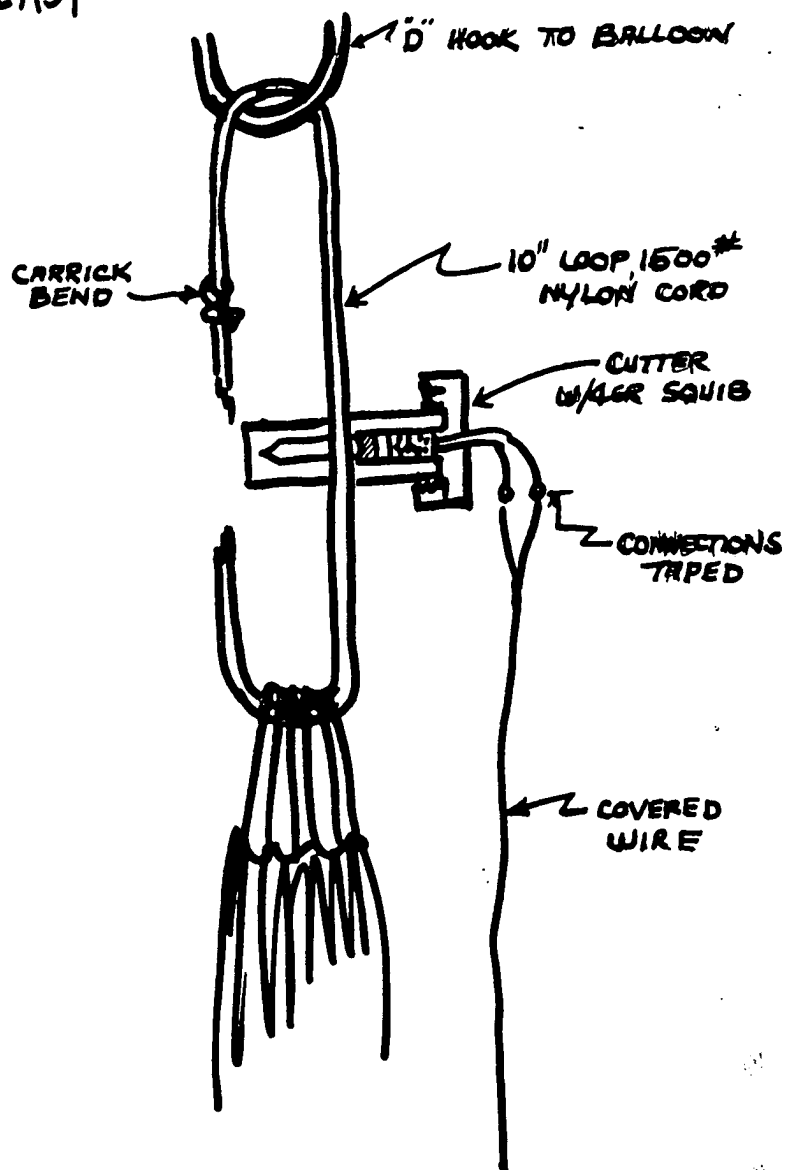
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FAR EAST



MDFE Cut-down Device

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PART III
COMMUNICATIONS

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I. COMMUNICATIONS:

A. During the initial communications planning for the project, no provision was made for direct circuits from the launch sites to the Launch Control Center, nor from this headquarters to the Launch and Recovery Control Centers. Direct circuits were planned from the Recovery Control Center to the recovery bases; however, no provisions were made for on-line encryption devices. (See inclosure 1, this Tab) The main system for encrypting classified information would be by off-line crypto systems. (3)

B. Upon assignment of the project to this headquarters, it was determined that in view of the unique character and complexity, rapid and secure communications would be of paramount importance. This headquarters, therefore, obtained direct circuits from the launch sites to the Launch Control Center and on-call direct circuits between this headquarters and the Launch and Recovery Control Centers. On-line encryption devices were obtained in addition to the off-line crypto equipment. All circuits in the 1st Air Division communication network were equipped with on-line encryption devices and all messages transmitted via the network were encrypted. The greater majority of the teletype operators of the 1110th Air Support Group and 456th Troop Carrier Wing had no previous experience with on-line operation or the AFSAM-7 crypto device. This headquarters, therefore made arrangements with Headquarters Strategic Air Command to train approximately 20 key Non-Commissioned Officers of the 1110th Air Support Group in on-line and AFSAM-7 operations at the Headquarters Strategic Air Command Communications Center prior to their departure overseas. (3)

C. In order to provide intensive training of all teletype operators in on-line operation on the 1st Air Division Communications Network, AFSAM-7 operation, and conduct a thorough shakedown of the circuits and equipment in the overseas areas, this headquarters conducted command post exercises beginning in October 1955, and continuing through December 1955. These exercises were from 3 to 5 days duration with periods in between for evaluation and corrective action. A brief synopsis of the results, problem areas, and corrective action taken for each command post exercise is contained in Paragraph G, this part. (U)

D. During the project, the Kodiak - Shiroi circuit never proved reliable. Headquarters United States Air Force allocated a circuit from Elmendorf to Adak in order that traffic between Kodiak and Shiroi could be passed via Adak. This circuit was of great assistance in passing traffic to and from Kodiak; however, the major problem area was the poor circuits between

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Kodiak and Elmendorf. In order to provide a reliable link between Elmendorf and Kodiak, the Alaskan Air Command activated a low frequency circuit which had a reliability of 98%. The provision of this circuit did not appreciably improve the overall efficiency of the Sitka - Kodiak circuit. On 14 January 1958, this headquarters activated a landline circuit from Offutt Air Force Base to Elmendorf Air Force Base for connection to Kodiak. By this method, this headquarters passed 787 messages between Kodiak and Sitka during the remainder of the project. (C)

2. Air/Ground Communication. In view of the complete and rapid control and coordination required between the Recovery Control Centers and aircraft performing recovery missions, a decision was made to augment existing selected Globeaircom Stations in the Pacific area and establish two new facilities at Adak and Kodiak in the Alaskan area. Recovery squadrons at Misawa, Johnson and Itazuke were to use the Fuchu station. Further, a group of four frequencies was provided at these stations solely for this project. The ARC-3 HF liaison set in the 456th Troop Carrier Wing aircraft was not considered capable of reliable communications due to the following factors:

1. Not crystal controlled.
2. Varying power output over the frequency range.
3. Required extremely accurate tuning in order to work with crystal controlled receivers at the Air Ground stations.

This headquarters therefore had 613 S1 HF crystal controlled transmitters installed in all C-119 aircraft of the 456th Troop Carrier Wing. Extensive tests were conducted to transmit the air/ground station, Fuchu. During these tests message volume and length were reduced and manning was increased at Fuchu air/ground station from the squadron and Recovery Control Center resources. Test results indicated that Fuchu could furnish adequate support. A frequency deficiency developed during the above tests in that the assigned 6 MC frequency was continually interfered with by a Chinese broadcasting station, two other frequencies were too high to cover the aircraft operating distances and the 6 MC frequency was subject to occasional atmospheric disturbance. This headquarters took action to replace the 6 MC frequency and obtain an additional frequency in the 6 MC range. When the project commenced, air/ground frequencies at the project stations were as follows: (C)

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1. 3067 KC
2. 5710.5 KC
3. 6760.5 KC (Fuchu and Okinawa only)
4. 11180.5 KC
5. 15016 KC

F. 4U Electronics System:

1. The 4U system is the C-119 airborne electronics equipment used in the 119L weapons systems to locate airborne balloon vehicles by VHF homing. In addition the 4U equipment communicates with the 4X electronics (balloon-borne) system by transmitting the cutdown code necessary to release the recoverable balloon-borne equipment. The 4U aircraft system is composed of the 1W Control Box, 1T Control Unit, 1V Antenna Switching Unit, 1H Antenna Array, MRT-6 Bendix-manufactured VHF Transceiver, and a pilot's Null Indicator. This equipment operates on a VHF frequency of 133.06 megacycles, frequency modulation. (3)

2. During the operational period of Project 119L, the only major malfunction encountered on the 4U electronic system was the breakage of antenna masts due to icing conditions. This situation did not become apparent until the 456th Troop Carrier Wing deployed to their overseas location. As soon as we were advised that the antennas were faulty, **action was taken to** obtain additional spare antennas, and Air Force Cambridge Research Center was requested to obtain a suitable antenna as soon as possible. In addition, the 456th Troop Carrier Wing found that **the** Antenna Mast AN/104-B, normally used with radio set AN/ARC-3, would operate satisfactorily although the power, and therefore the range, was reduced. When the antenna shortage became acute in late February 1956, the 456th Troop Carrier Wing was authorized to install the AN/104-B antenna mast in lieu of the project antenna in two aircraft of each recovery unit. No fully satisfactory solution to the antenna problem had been found by the time the project was terminated. (C)

G. Command Post Exercises:

1. Results 25 - 23 October Command Post Exercise:

a. Headquarters 1110th Air Support Group received a total of 480 exercise messages from their detachments with an average handling time of approximately 1 hour. (C)

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b. Headquarters 1st Air Division received a total of 380 exercise messages from Headquarters 1110th Air Support Group and Headquarters 456th Troop Carrier Wing with an average handling time of slightly more than 1 hour. (S)

c. Headquarters 456th Troop Carrier Wing received a total of 1105 exercise messages from their detachments with an average handling time of approximately 1 hour and 30 minutes. (C)

d. Problem Areas:

(1) Lack of skilled operating personnel. (U)

e. Corrective Action:

(1) More Command Post Exercises scheduled. (U)

2. Results 8 - 12 November Command Post Exercise:

a. Headquarters 1110th Air Support Group received a total of 179 exercise messages from their detachments with an average handling time of less than 30 minutes. (C)

b. Headquarters 1st Air Division received a total of 141 exercise messages from Headquarters 1110th Air Support Group and Headquarters 456th Troop Carrier Wing with an average handling time of less than 1 hour. (S)

c. Headquarters 456th Troop Carrier Wing received a total of 440 exercise messages from 5 recovery units with an average handling time of less than 45 minutes; however, 125 messages were received from Kodiak with an average time of 15 hours. (C)

d. Problem Areas:

(1) Excessive circuit outage Shiroi-Kodiak. (C)

e. Corrective Action:

(1) Headquarters United States Air Force was advised of circuit difficulty and assistance requested. (U)

3. Results 19 - 23 November Command Post Exercise:

a. Headquarters 1110th Air Support Group received a total of 257 exercise messages from their detachments with an

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average handling time of less than 30 minutes. (C)

b. Headquarters 1st Air Division received a total of 92 **exercise** messages from Headquarters 1110th Air Support Group and Headquarters 456th Troop Carrier Wing with an average handling time of slightly over 1 hour. (S)

c. Headquarters 456th Troop Carrier Wing received a total of 537 messages from the recovery units with an average handling time as follows: (C)

	TOTAL MESSAGES	AVERAGE TIME	
(1) Misawa	77	15 Minutes	
(2) Adak	161	33 Minutes	
(3) Kadena	95	3:20	
(4) Itazuke	123	4:00	
(5) Johnson	39	25 Minutes	
(6) Kodiak	42	9:23	(C)

d. Problem Areas:

(1) Unusual amount of circuit outage to Kodiak, Itazuke and Kadena during the Command Post Exercise. (C)

e. Corrective Action:

(1) Circuit outages referred to Headquarters Alaskan Air Command, Headquarters Far Eastern Air Forces and Headquarters 1808th Airways and Air Communications **Service** Wing for corrective action. (U)

4. Results 25 November - 2 December Command Post Exercise:

a. Headquarters 1110th Air Support Group received a total of 535 **exercise** messages from their detachments with an average handling time of less than 30 minutes. (C)

b. Headquarters 1st Air Division received a total of 123 messages from Headquarters 1110th Air Support Group and Headquarters 456th Troop Carrier Wing with an average handling time of approximately 1 hour. (S)

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c. Headquarters 456th Troop Carrier Wing received a total of 538 exercise messages from 5 detachments with an average handling time of approximately 45 minutes; however, the average handling time of messages from Kodiak was approximately 10 hours. (C)

d. Problem Areas:

(1) Excessive circuit outage Kodiak-Shiroi. (C)

e. Corrective Action:

(1) Headquarters United States Air Force's assistance again requested to obtain a reliable circuit. (U)

5. Results 8 - 16 December Command Post Exercise:

a. Headquarters 1110th Air Support Group received a total of 203 exercise messages with an average handling time of less than 30 minutes. (C)

b. Headquarters 1st Air Division received a total of 247 exercise messages with an average handling time of less than 1 hour. (C)

c. Headquarters 456th Troop Carrier Wing received a total of 623 exercise messages from 5 detachments with an average handling time of less than 1 hour. The average handling time of messages from Kodiak was approximately 3 hours. There were no problem areas. (C)

6. Results 28 - 30 December Command Post Exercise:

a. Headquarters 1110th Air Support Group received a total of 114 messages with an average handling time of less than 30 minutes. (C)

b. Headquarters 1st Air Division received a total of 98 exercise messages from Headquarters 1110th Air Support Group and Headquarters 456th Troop Carrier wing with an average handling time of approximately 2 hours. (S)

c. Headquarters 456th Troop Carrier Wing received a total of 493 exercise messages from their detachments with an average handling time of approximately $1\frac{1}{2}$ hours. There were no problem areas. (C)

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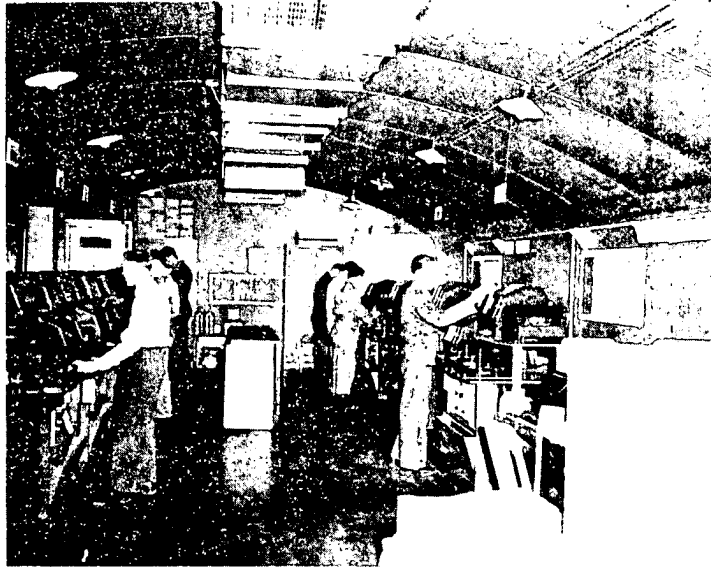
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H. Conclusion. Lack of on-line encryption equipment in Air Force support organizations subjects a project of this magnitude to a high probability of compromise, due to lack of communications security. Several instances of messages transmitted from Zone of Interior organizations to overseas addressees in the clear and intercepted by United States Air Force Security Service Squadrons in the Far East and Europe, permitted those squadrons to pinpoint unit locations, controlling headquarters, project purpose, participating commands, etc. (S)

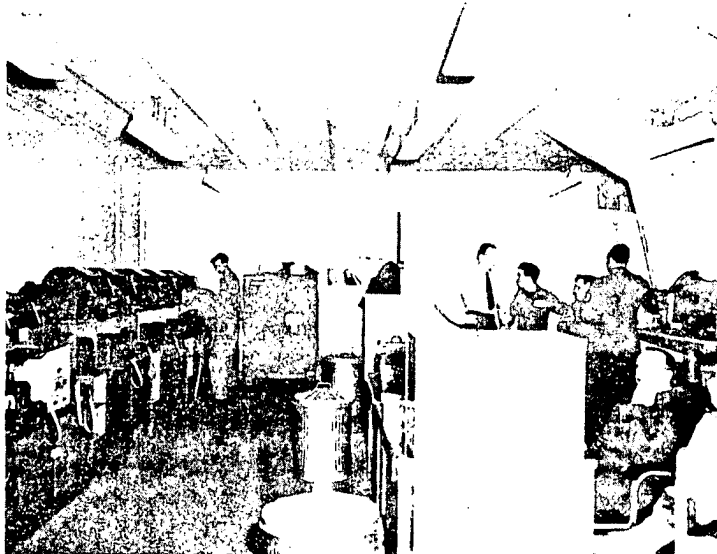
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Recovery Control Communication Center
Shiroy AB, Japan



Launch Control Communications Center
High Wycombe, England

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PART IV

COVER LAUNCHES

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I. COVER LAUNCHES

A. On 28 December 1955 Headquarters United States Air Force held a conference to revise certain aspects of the Project Cover Plan. One area of consideration was the relationship of previously and currently conducted balloon launch programs with Project 119L. This would indicate that the Air Force was continuing and expanding a world meteorological survey program. (S)

B. Since the Air Force had supervised and/or participated in balloon launches in Panama, Brazil, Scotland, Japan, Norway, Hawaii, Korea, and the Zone of Interior in previous programs, it was decided to publicize these operations as a part of the world wide program. In addition it was deemed advisable to have one launch program in effect during the conduct of 119L. This was accomplished by the continuation of the Moby Dick Far East program that had originally been initiated to provide training for the 6926th Radio Squadron Mobile prior to commencement of 119L. (S)

C. To implement this cover plan launch program, Headquarters 1st Air Division published 1st Air Division Operations Order 207-56. This was exercise White Cloud, which provided for balloon launches during the period 9 January 1956 to 1 July 1956. (S)

D. Since the Moby Dick launch team consisting of one officer and six airmen were currently at Kadena Air Base, Okinawa, it was planned to launch the remaining 12 Moby Dick Far East balloons from Kadena Air Base during the period 9 January to 1 March 1956 as the first phase of White Cloud cover plan launches. (S)

E. During the interim, 20 additional 124A balloons were procured; 10 each being sent to Wheeler Air Force Base, Cahu Island, Territory of Hawaii and Elmendorf Air Force Base, Alaska. (S)

F. The second phase of this cover launch program was to launch 10 balloons from Wheeler Air Force Base during March and April with the third phase to be conducted at Elmendorf Air Force Base during May and June. (S)

G. As this was a modified launch program on a reduced scale the launches were to be accomplished by deploying the one launch team to the next launch site on termination of each phase. (U)

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H. The configuration differed (from the Moby Dick Far East systems) for the 20 additional balloons procured as follows: (See inclosures 1, 2, and 3)

Configuration for Moby Dick Far East balloons used at Kadena Air Base

1. Balloon, 124A
2. One ballast hopper
3. Electronics Box containing batteries, control box, HF transmitter, antennas and water bottles.
4. All harnesses, cabling and minor fittings as required, to complete the gondola.
5. One (1) 24 foot safety parachute (rigged open as the 64 foot chute was for ZI 119L release).
6. Sub bar.

Configuration for 20 new balloons for Wheeler and Elmendorf

1. Balloon, 124A.
2. Cut-down device with squib.
3. 24 foot overage personnel chute.
4. 1/2 inch clevis pin.
5. Equipment 32 box (ballast box).
6. Radiosonde.

(S)

I. It is to be noted in the above configurations that no special efforts were made to obtain raw meteorological data. In fact, the attached radiosondes were not required to be serviceable. The requirement was to provide support for the cover plan, therefore the most economical system possible was designed and employed. (S)

J. In keeping with the desire to publicize a world wide meteorological program, balloons launched on the 9th and 27th of January at Kadena Air Base, Okinawa were termed publicity launches. Far Eastern Air Force ISO representative invited news media personnel to witness and photograph these launches. Both launches were operationally successful and emphasized the meteorological aspects of the program as desired. (See inclosures 4 and 5) To add to the cover aspect, gondolas used in these launches were 119L system mock-ups. (C)

K. To further emphasize the scope of the Air Force program, a 119L gondola mock-up, less cameras and sensitive

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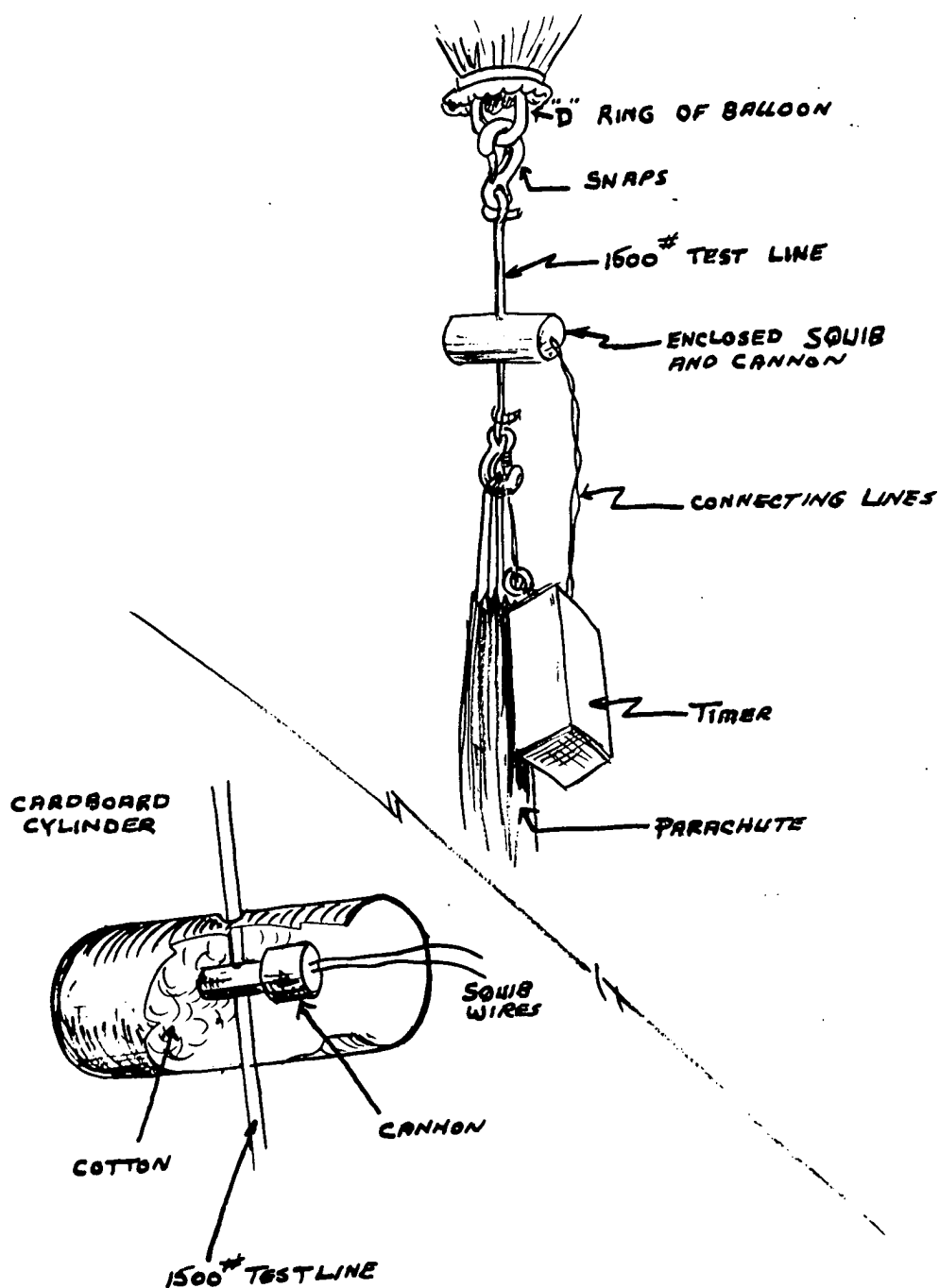
equipment, was prepared for exhibit during publicity launches at Wheeler Air Force Base and Elmendorf Air Force Base. Since the balloon launch at these sites were a different configuration than Project 119L system it was considered advisable to have this mock up available. This would indicate that the Air Force program was flexible and of considerable magnitude, due to various systems employed to gather the desired data. Pictures of the Kadena publicity launches and news releases generated are contained in this Tab. (S)

L. Funds for the continuous TDY of the White Cloud personnel for fiscal year 1956 were provided by Strategic Air Command in the estimated amount of \$3,800. Hydrogen for the Alaskan site was to be procured by Air Materiel Command from the Zone of Interior. Commercial hydrogen for the other 2 sites and normal base support was to be provided by the theater commander. Total cost for procurement of new materiel by Air Materiel Command was \$5,106. (U)

M. On completion of the White Cloud balloon launches at Kadena AB, Okinawa, the launch team and equipment were deployed to Wheeler AFB, Oahu Island, T. H., to commence the second phase of launching on 5 March 1956. During this deployment the Commander 7th Air Force, Wheeler AFB, T.H., advised by SECRET message 7FOOT 00107 dated 2 March 56, that Department of Commerce members and certain civic association members of the Honolulu Regional Air Sub-committee were objecting strenuously to the Air Force proposal outlined in Case 306 which pertained to balloon launches from Wheeler AFB. The objection was due to the lack of an Air Force communications capability to positively track and position free flying balloons in compliance with paragraph 2D, AF Regulation 55-13 title "Release of Free Balloons". A final meeting of the Honolulu Sub-committee on 15 March 56 confirmed disapproval of balloon launches from Wheeler AFB, Oahu Island, T. H., due to the lack of a satisfactory tracking capability. The Air Staff, Headquarters USAF, was informed of the disapproval by 7th Air Force SECRET message FOOT 00136 dated 22 March 56, and also advised that minutes of the meeting were being forwarded under separate cover. Pending Headquarters USAF action, Headquarters 1st Air Division continued necessary planning for conduct of Exercise White Cloud. A filled hydrogen trailer and launch equipment were shipped from Japan to Elmendorf AFB, Alaska, for support of the third phase. Balloon systems for the third phase were procured and held at Offutt AFB, Nebraska, to be shipped as required. On 22 March 56, a member of the launch team was sent to Alaska for final coordination of launch site preparations. During this interim period, coordination was being effected between Air Staff, USAF, and the State Department to determine the need for continuing Exercise White Cloud. On 27 March, Headquarters USAF advised that the State Department decision was to terminate the exercise. This decision was disseminated in Headquarters USAF message AFOOP-K 58299. (S)

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Cut-down System for Exercise "White Cloud"

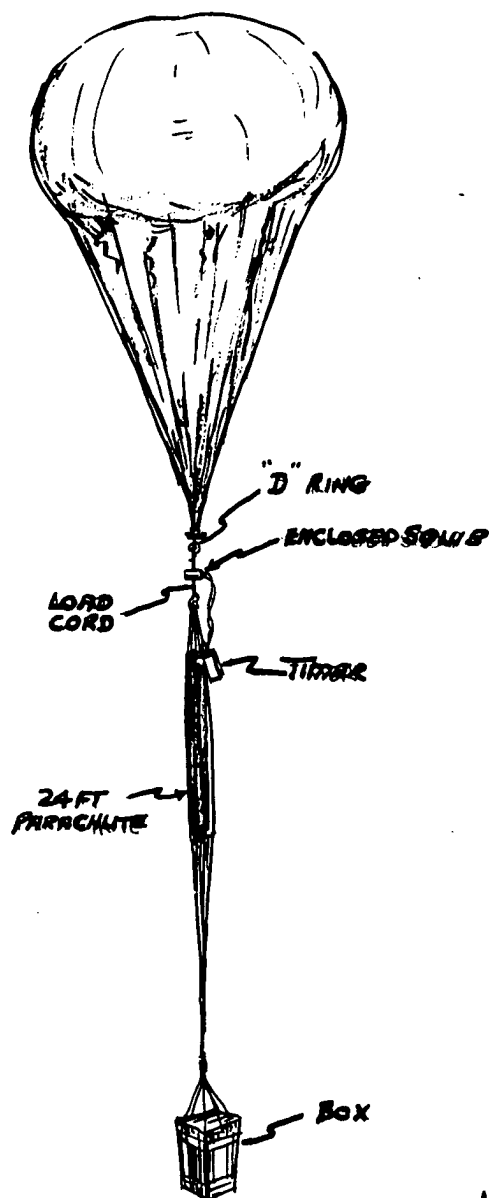
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GENERAL MILLS and WINZEN SYSTEM

System Configuration for Exercise "White Cloud"

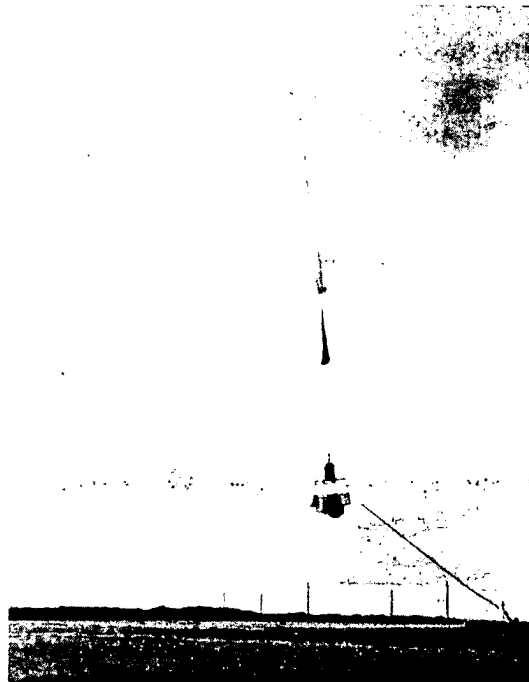
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White Cloud Publicity Launch

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JANUARY 21, 1956

AIR FORCE TIMES 17

Meteorological Sites Planned for Hawaii

HICKAM AFB, T. H.—A meteorological research station will be reactivated in Hawaii in the near future, the Air Force announced recently. The station will launch large plastic balloons to gather meteorological information at altitudes above 30,000 feet. Similar balloon research flights were conducted here during 1954 and 1955. The research station will probably be situated on Oahu.

The balloons are used to obtain information on wind patterns, cloud formations, frontal systems and other atmospheric phenomena. The studies here are a part of an AF meteorological survey that is being conducted in other areas of the world.

An Air Force meteorological survey, using plastic balloons commonly known as "Moby Dick" which have often been mistaken for "flying saucers," will carry meteorological instruments, including cameras, to photograph clouds and radio equipped to record and telemeter atmospheric information.

This method of obtaining meteorological research data could be of great use in the international geophysical year programs that will be conducted during 1957-58.

Balloons are, in effect, miniature satellites that can remain aloft for several days and thereby collect continuous meteorological research data.

The research data obtained will enable our scientists to better understand the many meteorological phenomena that exist in the vast unexplored region surrounding the earth. Thus, information will be obtained that may be of importance when a man-made satellite is fired into space within the next few years. The program is designed to obtain meteorological observations in northern hemisphere and it is expected that new information will be obtained on jet streams, pictures of clouds systems associated with frontal systems and storm forma-

tions with electro-magnetic radiation and radio propagation.

By studying the complete general circulation and cloud patterns we can learn more about the causes of severe weather.

It is hoped that the information obtained may help explain recent unusual weather occurrences in the U. S. The 1955 hurricane paths shifted from their normal courses and brought disaster along our eastern coastal area. Dust storms and gale winds caused extensive damage to crops in the midwest. Heavy rain falls caused floods in the west and northwest that have never been experienced before.

The U. S. Weather Bureau is interested in this program and the data will be analyzed in an attempt to improve forecasting and to provide early warnings of severe weather phenomena. More than 1000 balloon flights have been conducted without interruption or hazard to aerial navigation.

In order to preserve and continue this excellent safety record, fool-proof safety devices are used on all balloon flights. Experience has also shown that balloon flights are not a hazard to aviation when flown at altitudes above 30,000 feet.

Since commercial aviation and most military aviation are presently conducted below 30,000 feet, balloons are prevented from floating below this level by safety devices. A balloon that fails to reach 30,000 feet within 50-60 minutes after released automatically destroyed and the equipment is lowered to earth by parachutes.

Likewise any balloon that descends to 30,000 after passing through that altitude, is also destroyed. The destruction of the balloon is rather simple. By cutting away the attached equipment by use of a safety device, the balloon rises rapidly in the sub-freezing stratosphere where expansion of lifting gas will cause it to burst.

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Kadena Air Force Launches Studying House-Sized Balloon Upper Air

TOKYO (FEAF)—The Far East Air Force announced that research studies into upper atmospheric conditions are being continued from Kadena AFB on Okinawa.

The studies, using high-altitude meteorological balloons, were begun in September in Korea and on Okinawa. Launchings from Korea have been completed.

The balloons are used to gather information on wind patterns, cloud formations, frontal systems and other atmospheric phenomena at altitudes above 30,000 feet.

The studies in the Far East are part of an Air Force meteorological survey which is being conducted in other areas of the world.

LOS ANGELES (UP)—The U.S. Air Force announced Wednesday that a newly-designed meteorological balloon, big as a two-story house, was launched Sunday in the continuing study of the causes of recent severe storms in the U.S.

The giant plastic balloon which towers upward some 50 feet from its "tail" of meteorological instruments to its dome flies at altitudes above 30,000 feet and is no danger to commercial airline traffic which is confined to altitudes below that, the Air Force said.

The first of these new designs was set loose by the Air Force at Vernalis, Cal. The Air Force meteorological study has been dubbed "Moby Dick."

AIR FORCE scientists hope that the information obtained may help explain, for instance, why the 1955 hurricane

shifted off their normal courses to bring disaster to the Eastern Seaboard, and the causes of dust storms and gale winds that damaged Midwestern crops.

The Air Force believes the data collected by the cameras, radio equipment and other meteorological measuring instruments will be of great value during the International Geophysical Year programs to be conducted during 1957-1958.

More than 4,000 balloon research flights already have been conducted. Safety devices prevent the balloon from hanging below 30,000 feet.

The devices automatically destroy the balloon if it fails to reach the 30,000-foot level within 50-60 minutes after release or if it descends below that level after reaching the safe altitude.

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CHAPTER III
PRIMARY MISSION

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TAB A

THE BALLOON

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I. BALLOON.

The 119L vehicle consists of 3 main groups; a balloon which is discussed in this tab, and the suspension system and gondola as described in Tab "C".

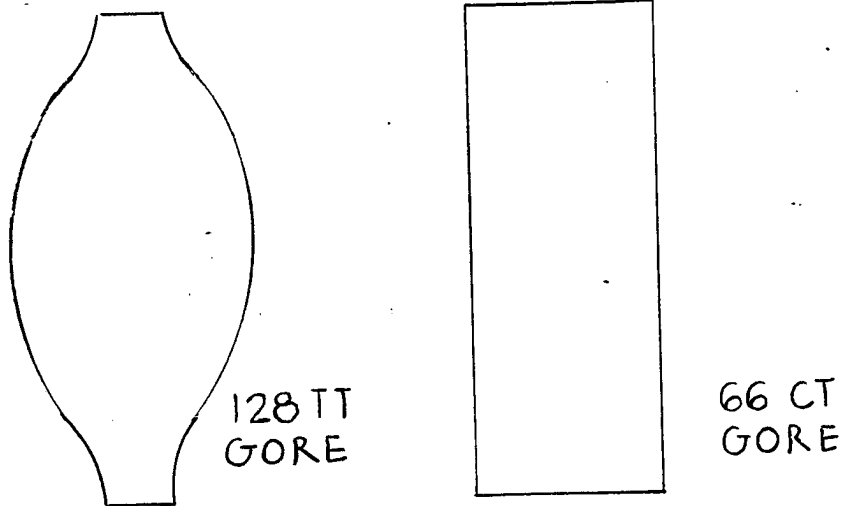
A. Balloon:

1. There are two types of balloons utilized in the 119L vehicle, a 128TT and a 66CT. The balloons are similar in that each is made from a plastic known as polyethylene, are gas envelopes, and utilize the concept of what is known as the "natural shape". The natural shape is a design calculated to keep the circumferential tension in the balloon fabric equal to zero. This means that there would be no tendency to strain the balloon film into a larger diameter at any fabric level. The stresses on the balloon surface are related to supporting the payload, the balloon weight, and the gas pressure. The stresses tangent to the balloon surface and in a vertical plane are called meridional stresses. Since the balloon surface is curved there is a force per unit area toward the center of the balloon. This force on a balloon surface is opposed by the difference in pressure of the gas inside and outside the balloon. If the force per unit area created on the curved surface by the meridional stress is equaled by the gas pressure, the balloon is designed for a "natural shape". This design concept is fundamentally useful in that the balloon film is therefore stressed uniaxially rather than in two directions. It allows one to preferentially utilize the most favorable orientation of the polyethylene film. Since the natural shape design depends upon the ratio of the balloon weight to gross load, this balloon is designed for its most oblate shape. This is a design problem specifically associated with a duration type balloon system that loses about 50% of its gross weight by dropping ballast and thereby causing a continuing change in the shape of the balloon. The balloon for 119L has its most oblate shape at the end of its duration flight; for this reason the natural shape is designed for that diameter and therefore represents a design that has no circumferential tension at any time during its floating life. (C)

2. Both the 128TT and the 66CT balloons are constructed of polyethylene gores, but the shape of the gores differs as follows:

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3. A further breakdown of the two balloons is as follows: (U)

a. 66CT Balloon:

- (1) Volume with gross load of 2000 pounds - 124,000 feet.
- (2) Volume with gross load of 1340 pounds - 125,000 feet.
- (3) Gore length - 96.25 feet.
- (4) Diameter - 66.80 feet.
- (5) Height of inflated balloon - 63.0 feet.
- (6) Weight of balloon (+ or - 5 pounds) - 225.0 pounds.
- (7) Thickness of polyethylene - 0.002 inches.
- (8) Number of Gores - 25. (U)

b. 128TT Balloon:

- (1) Volume with gross load of 2000 pounds - 740,000 cubic feet.
- (2) Volume with gross load of 1340 pounds - 760,000 cubic feet.

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- (3) Gore length - 176.5 feet.
- (4) Diameter - 128.0 feet.
- (5) Height of inflated balloon - 106.0 feet.
- (6) Weight of balloon (+ or - 5 pounds) = 555.0 pounds.
- (7) Thickness of polyethylene - 0.002 inches.
- (8) Number of Cores - 46. (U)

B. A high failure rate was known to exist in the lower serial number 128TT balloons. This was determined during the conduct of the Moby Dick Hi OST and was borne out during the early stages of the primary mission. On 14 October 1955, due to the results of Moby Dick Hi, this headquarters requested the development of an intermediate type balloon (83CT), which was to have a high degree of reliability and operational dependability. Headquarters United States Air Force concurred in this requirement. In order to take advantage of the predicted period during which favorable wind trajectories would exist over the target area, this was established as an urgent requirement. This headquarters requested expeditious testing production, and delivery. The testing was to include ascent to initial altitude and load carrying capability only. The flight duration was not to be tested since it was believed to be comparable to that experienced with the 66CT and 128TT. It was expected that production 83CT balloons would be delivered to the 1st Air Division commencing 1 March 1956. Test launchings commenced at Vernalis, California by Air Force Cambridge Research Center on or about 27 February 1956. Due to termination of the primary mission, the 83CT balloon was not employed during actual operation. (S)

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TAB B

THE GONDOLA

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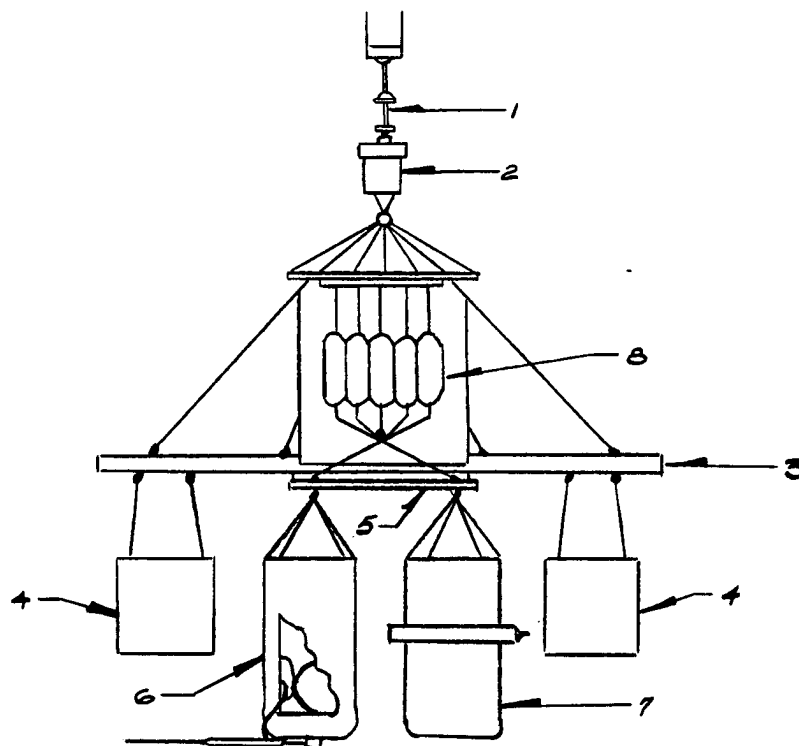
I. THE GONDOLA: A brief description of the Suspension System, Gondola **and** its component parts is contained in this Tab. Due to the magnitude of gondola assembly requirements, each launch detachment established an assembly line. Components of the gondola suspension system were prepared in the individual shops and, after an operational check, were stockpiled on the assembly line. (See photos contained in this Tab). (U)

A. Suspension System. The gondola is connected to the balloon by means of a load strap. The load strap is a 25½ foot length of webbing with a loop sewn at each end. To this standard load strap, an extension of 10,000 pound test nylon coreless cord has been added to facilitate **the** release of the balloon from the launch cart. (Tab D, Chapter III) In the case of the 123TT, the addition is 25 feet long and for the 66CT, the addition is 75 feet long. The standard load strap is threaded thru and attached to an overage, 24 foot personnel parachute (Tab B, Chapter III). This is a safety feature that, in the event of balloon failure due to a burst at altitude, stabilizes the gondola descent to a lower altitude where the main package **seperates** and descends on a cluster of 4 -- 24 foot parachutes while a lighter load descends on the 24 foot safety chute. The parachute also acts as a safety device upon flight termination, activated by either a recovery aircraft or ground cut-down station, in that upon bar separation the 24 foot safety chute **lowers** the empty ballast boxes, rotator and long bar; thus the possibility of "free-falling" objects inflicting damage to personnel or property is avoided. (TS)

B. Gondola. This is the main part of the 119L system and is shown below by a diagrammatic presentation of the entire gondola which is suspended from the balloon by the suspension system described above:

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At the top of the gondola assembly is an eye-bolt (1) (dog-bone) by which the equipment is supported, and a rotator (2) which is electrically activated to slowly turn the arrangement beneath it. Below the rotator hangs the main pole (3) (sometimes called the main bar), from which two ballast boxes (4) and a sub-pole (5) are suspended. From the latter hang two boxes: the thermal box (6) (containing the control and communications equipment) and the DMQ-1 box (7), which contains equipment for the performance of the mission. These poles support cabling which electrically interconnect major components of the system. A cluster of five parachutes is attached to the sub-pole so that at the conclusion of the flight the equipment on the sub-pole may be safely lowered. (C)

C. Breakdown of Equipment. The following diagrams show each sub-unit in the assembly of a complete 119L gondola. They are in order of attachment: (U)

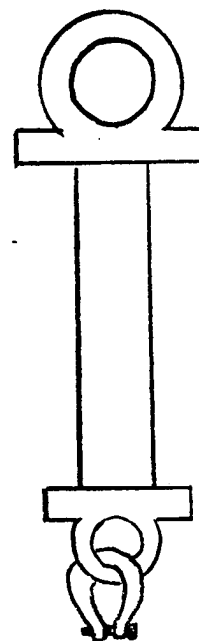
1. Eyebolt.

Sometimes referred to as the dog-bone.

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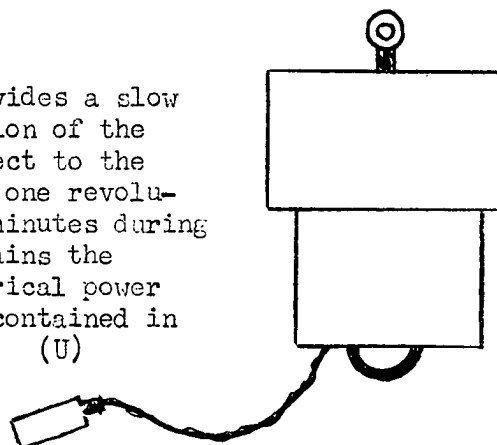
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This bolt is used to connect the suspension system to the clevis pin at the top of the rotator. It is also the means of attaching the gondola to the release mechanism of the Fisher Launcher. (U)



2. Rotator.

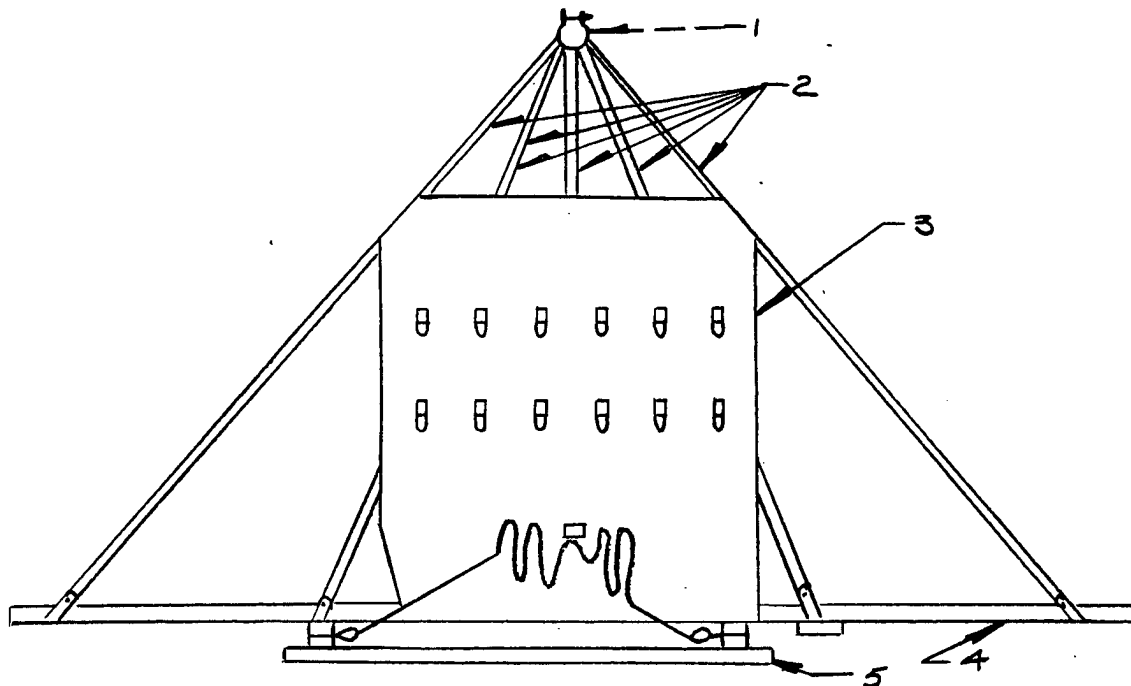
The rotator provides a slow incremental motion of the gondola in respect to the balloon, making one revolution every 100 minutes during flight. It obtains the necessary electrical power from batteries contained in the thermal box. (U)



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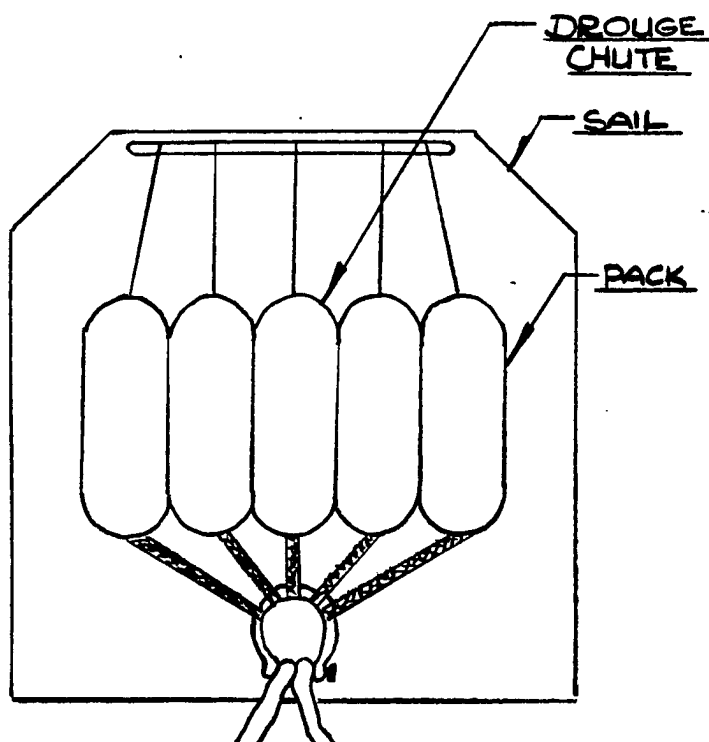
3. Main Bar Assembly. The main bar assembly serves as a supporting link and electrical wire conduit between the rotator, and the sub-bar assembly. It consists of coupling link (1), supporting straps (2), sail (3), and a long strut called the main pole (4). The short pole (5) or sub-bar assembly is attached to the bottom of the long pole. (U)



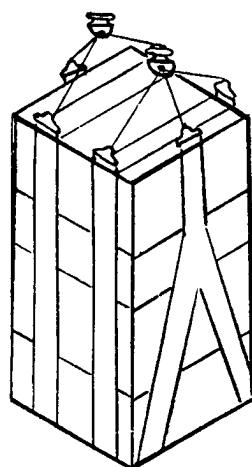
4. Parachute Cluster. The pack, which is attached to the sail of the main bar assembly, consists of a 12 foot drogue and four 24 foot cargo chutes. As the sub-bar separates from the main bar, the 5 parachutes to which it is attached are pulled from their covers and deployed. Their function is to lower the gondola assembly at a descent rate of 1500 - 2000 feet per minute. The rotator, main bar, parachute covers, and ballast boxes, descend on the 24 foot safety chute. The drogue chute is a nylon reinforced canopy that facilitates air recovery. See Tab "C", this Chapter. (U)

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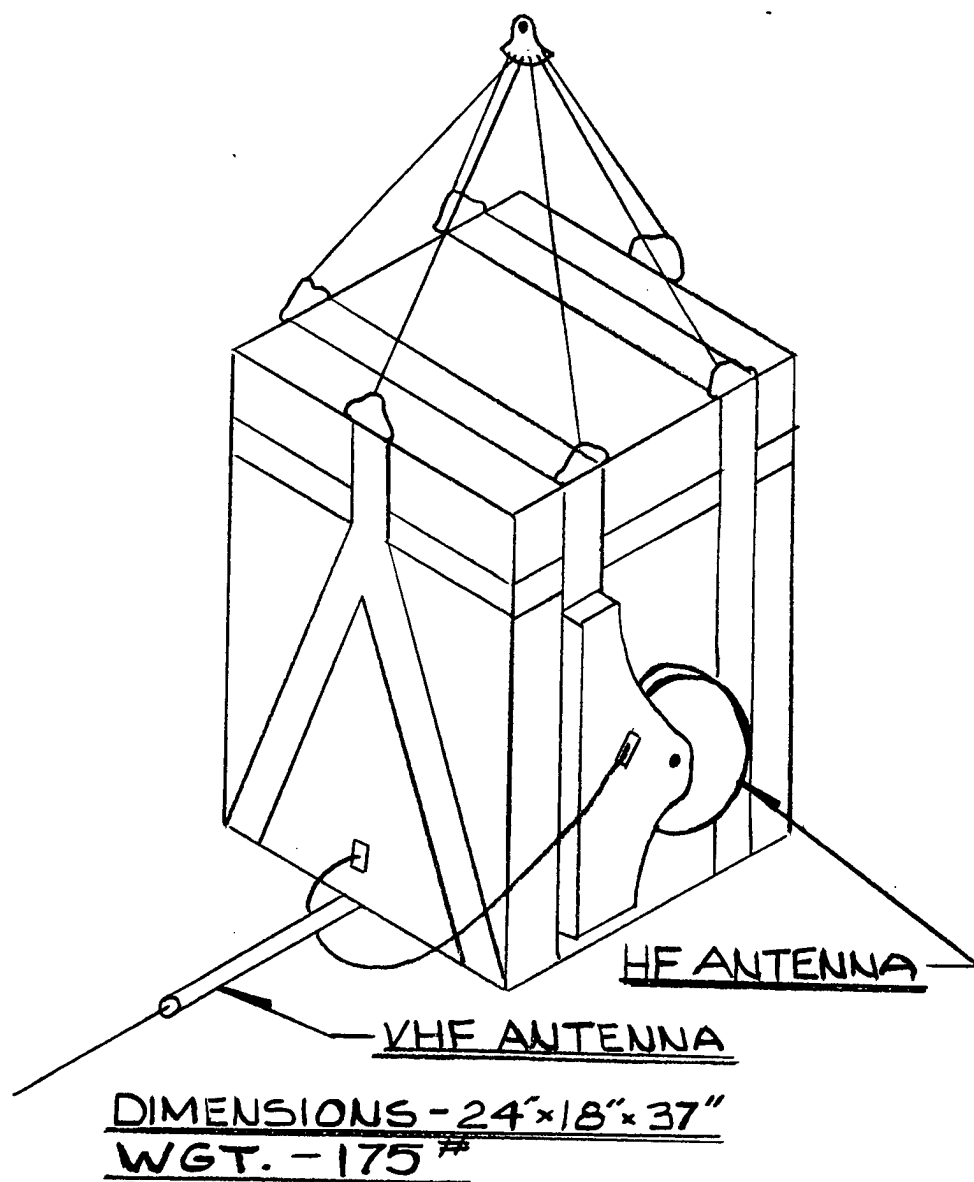
5. Ballast Boxes. The system includes 2 ballast hoppers, one of which is attached to each end of the main bar. These are box-like cardboard structures designed to hold approximately 600 pounds each of fine steel dust, and to provide gravity discharge of the dust by electrically controlled valves located in the bottom of each box. Explosive squibs are located so as to obtain a fast discharge of ballast in the event of balloon failure or package "cut-down". A picture is shown below: (C)



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6. Thermal Box. The electrical package (also called the thermal or instrument box, is an insulated, moisture resistant, cardboard container for all the communication, control, and power components of the 4X system. On the outside of this package are mounted the HF and VHF radio antennas, with the VHF dipole antenna underneath and HF antenna reel on a bracket attached to the package side. Note figure below. (U)



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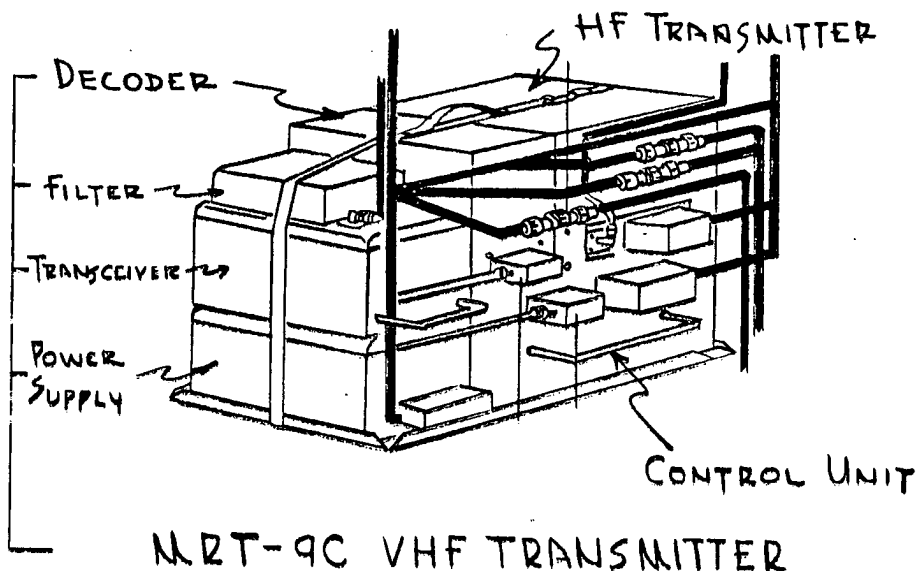
a. Inside this package, from the bottom up, are packed **the** battery box (1), the water-bottle box (2), and the instrument tray (3) with the interconnecting cable running up two inside corners. Note drawing below and on following page. (U)

b. The battery **box** contains four zinc-silver-peroxide batteries filled with potassium hydroxide electrolyte and 32 plastic water bottles. With the exception of some DMQ package requirements, all electrical power is **furnished** from this battery box. (U)

c. The water-bottle box contains 37 plastic water bottles and the Auxiliary Ballast Control Unit, which required space equivalent to 3 water bottles. Additional thermal stability is provided to the electronic package by the water bottles. The Auxiliary Ballast Control Unit, which conserves ballast in its operation, mechanically resets **itself** to any change in altitude and permits stool dust discharge **from** the ballast hoppers **only** when the balloon is descending below a pre-determined ballasting altitude. (U)

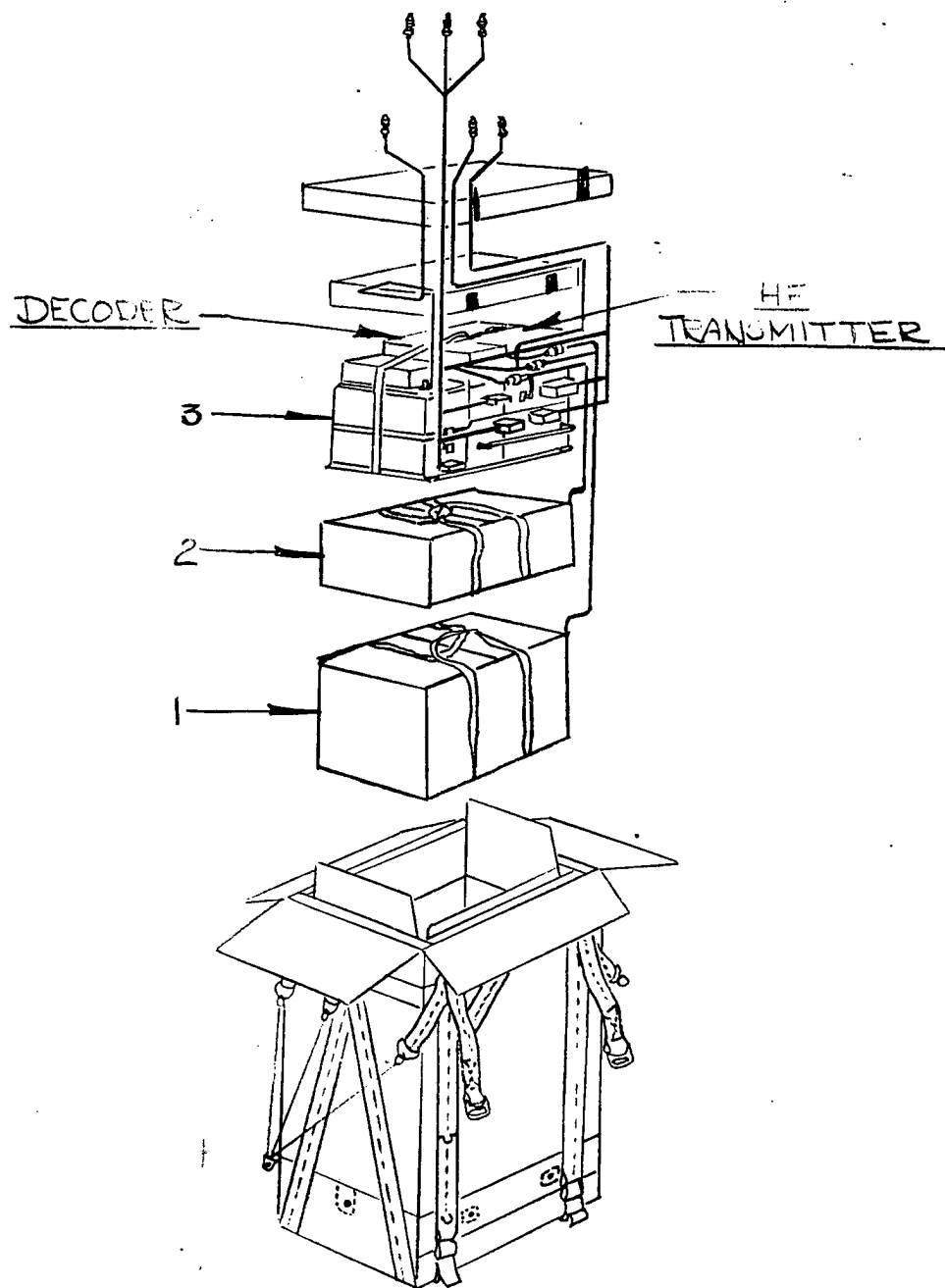
d. The instrument tray mounts four major components, the Control Unit, the HF transmitter, the Decoder, and the VHF transceiver, all secured together with a strap. (C)

INSTRUMENT TRAY



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7. 2G-EO Unit. The auxiliary safety unit, 2G-EO, is an altitude operated safety device which prevents free-fall of the gondola without parachutes should balloon failure occur soon after launch and above a pre-determined altitude. It accomplishes this by disposing of the contents of the ballast hoppers and by separating the bars in the suspension system to permit the parachutes to bring the electronic and mission equipment down safely while the safety chute lowers the ruptured balloon, main bar and **ballast hoppers**. This unit includes two altitude-activated (aneroid) switches to arm the circuits, a time-delay for sequential switching, and a safety diode to prevent launch shocks from triggering this device. The 2G-EO safety unit is mounted on the under side of the main bar of the 119L system, near the sub-bar attachment, and above the DMQ package. Power is provided from the electronic package battery pack, but otherwise the unit operates independently of the rest of the 119L system. Aneroids are adjustable for altitude and are set by hand with simple, gauge-type tools. The units dimensions are $6\frac{1}{2}$ " X $3\frac{1}{2}$ " x 3" and it weighs a total of $1\frac{1}{2}$ pounds. The device functions as shown in "Safety Configuration" chart contained in this Tab; however, it was never flown in actual operation due to the cessation of operations prior to receipt in the field. (C)

8. The Control Unit, 1B-E5, provides control of all equipment in the 119L system through a network of cam-operated micro-switches, odometer-operated micro-switches, aneroid (altitude barometer)-operated micro-switches, and relays inter-connected for sequential and cyclic operation by means of gear trains driven by a constant time rate motor and a code generating motor. See "Safety Configuration" chart contained in this Tab. (U)

a. Timer motor driven cam-operated micro-switches control voltage output for the following functions: (C)

- (1) Rotator operation every 25 seconds.
- (2) DMQ-1 camera operation every 6.25 minutes.
- (3) VHF transceiver operation for 2 minutes out of every 15 minutes during Manual cycle, and continuously during extended cycle.
- (4) HF transmitter operation for 90 seconds every 30 minutes.
- (5) Auxiliary ballast on-off motor operates for 22.5 seconds every 3 minutes to adjust itself. (C)

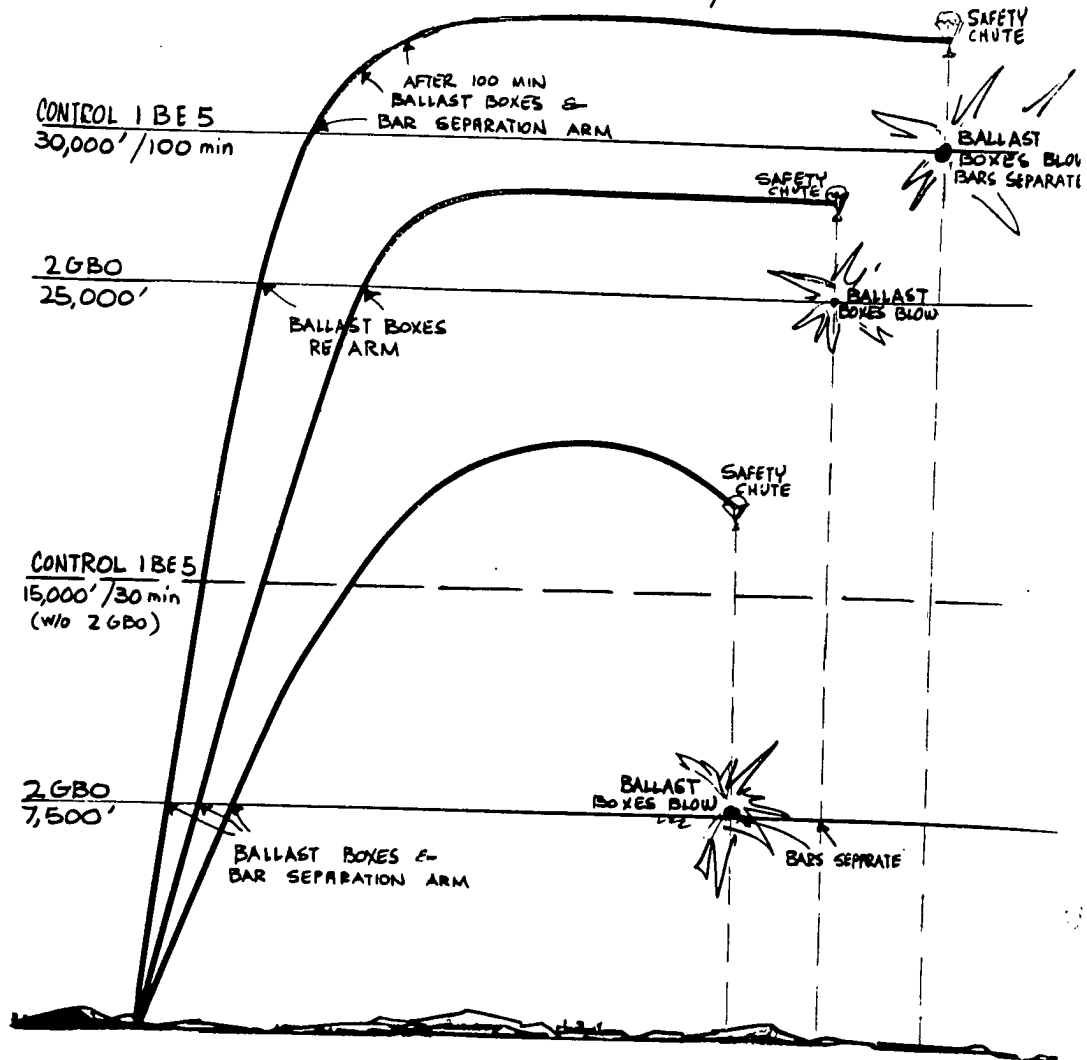
b. Codex motor driven cam-operated micro-switches control voltage output to provide:

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Safety CONFIGURATION

with 2 GBO Aux. Safety Unit



Description of Operations
(2G-B0 and 1B-E5 Units)

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- (1) A single source of Morse code fed to both VHF and HF transmitters. (C)
- (2) HF transmission for D/F tracking by alternating 30 seconds of code and 42 seconds of code and 42 seconds of tone every 72 seconds. (C)
- (3) A re-set synchronizing circuit for the coder motor after each coding cycle. (C)

c. Timer motor driven odometer-operated micro-switches turn voltages on or off for the following operations:

- (1) Start ballasting and release radio antennas. (C)
- (2) Provide voltage to arm the safety circuit, which blows out the ballast hoppers and separates the sub-bar from the main bar of the suspension system. (C)
- (3) Start camera equipment operation. (C)
- (4) Stop camera equipment operation. (C)
- (5) Start HF radio equipment operation. (C)
- (6) Start VHF radio equipment operation. (C)

d. Aneroid-operated micro-switches turn voltage on and off, when the aneroid expands or contracts dependent upon the barometric pressure, for the following functions:

- (1) At the set altitude when the safety circuit is to jettison equipment in case of balloon mishap. (C)
- (2) At the set altitude for ballasting. (C)
- (3) At the set altitude for release of the electronic package from the sub-bar. (C)

e. The HF transmitter, IC-JC, consists of a power supply, a crystal-controlled oscillator, a keying circuit for coding and a radio frequency power amplifier which can deliver 17.5 watts to the HF antenna. On normal cycle it operates every 30 minutes for 90 second transmitting, for D/F tracking, its three-letter Morse code identifier five times for 20 seconds, followed by 42 seconds of solid tone, and its identifier three times for 12 seconds. Upon flight termination, this transmission cycle

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repeats itself continuously. Removable crystals and tank circuit kits permit field shop changes to use any one of 13 different high frequencies. (S)

f. The Decoder, 1M-A6, consists of twelve conventional relays and a stepping relay, with a ratchet gear and wiper-arm assembly. This unit receives from the VHF receiver the dialed code group consisting of six different numerals as sent from an outside transmitter using a telephone dial, evaluates these six trains of audio pulses by either accepting or rejecting them as they progress through the relay train, and passes the resulting information to the Control Unit. (S)

g. On normal cycle, the VHF transceiver operates every 15 minutes for 2 minutes sending out its three-letter Morse code identifier ten times the first minute followed by a listening period for the second minute. Only during this 60 second receive time will the balloon system accept outside VHF CW transmissions and then only if these contain the correct code of six dialed digits coming in on the receiver's particular filter channel. If the channel and first four digits are right, the MRT-9C starts its extended cycle, alternately transmitting for 3 minutes and listening for 2 minutes. During the listening time if any incorrect digit is received, the decoder rejects it by tripping one relay and "tilting out" all previously received digits. Then the VHF transceiver is returned to its normal cycle. When the fifth and sixth digits are correctly received during any listening period, the termination operation (separation of the sub-bar from the main bar, blowing the ballast from the hoppers, and descent of the electronic and mission packages on the chute cluster) is indicated by continuous VHF transmission of the three-letter code identifier. (S)

The VHF transceiver, MRT-9C, consists of: (C)

- (1) A crystal-controlled frequency-modulated transmitter, operating at 133.060 megacycles.
- (2) A crystal-controlled superheterodyne frequency-modulated receiver tuned to 133.060 megacycles and connected with a sharp cut-off audio-frequency filter resonant to one of four pre-selected channel frequencies.
- (3) A vibrator power supply.

9. DMQ-1 (Photographic Reconnaissance Package). (TS)

a. The DMQ-1 is a fiberglass box designed to enclose the camera equipment. It was lined with six inches of styrofoam for insulation and contained a duplex camera, a position camera, a device, a junction box, 280 water bottles, and, in some configurations, a battery. The battery when installed provided a power source independent from the thermal package power supply. Two glass plate

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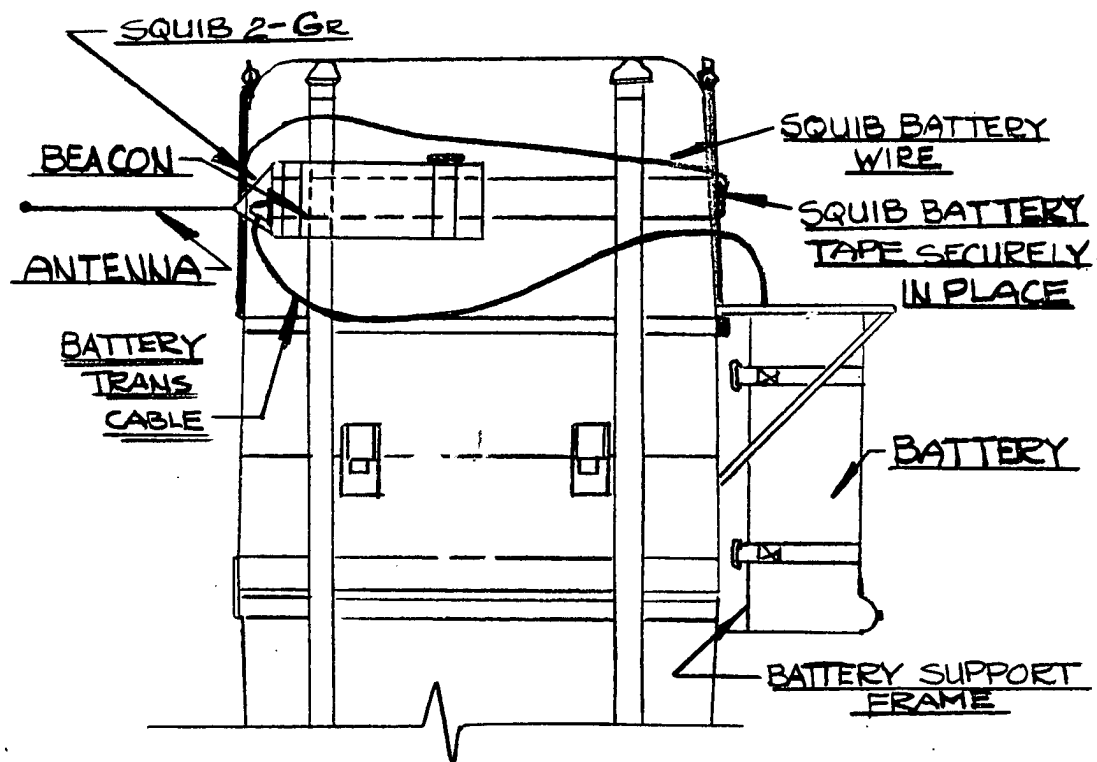
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windows were installed on the bottom of the DMQ-1, through which the duplex camera obtained photography. (S)

b. The above equipment was secured on a metal rack (see photo contained on inclosure 2 this Tab) and the rack then placed in the bottom half of the DMQ-1 fiberglass box. The water bottles were added to provide a source of heat during flight. When the top half of the fiberglass was secured in position, the entire DMQ-1 was brought to a true level by adjustment of turn-buckles. Dimensions of the DMQ-1 fiberglass box are 36" X 30" X 57" and the weight is approximately 330 pounds. (C)

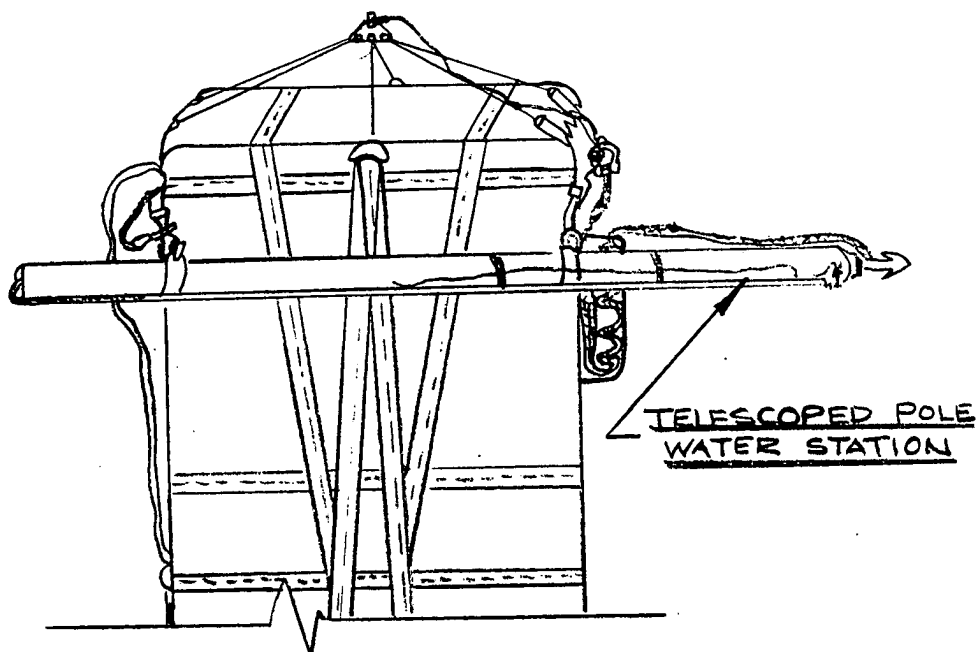
10. Locator Beacon. The beacon is a UHF transmitter. It is powered by a salt water activated battery so arranged that when the DMQ box is dropped into the sea, the battery will activate in a period of less than twenty-five minutes and start the beacon on pre-arranged transmission program. The complete transmitter unit weighs approximately 5 pounds. The water activated battery weighs approximately 23 pounds. The antenna is telescoped into the transmitter unit and held in place with a nylon cord. This cord is broken upon launch and the antenna erected by a spring within the beacon case. See Tab "C", this Chapter. (C)



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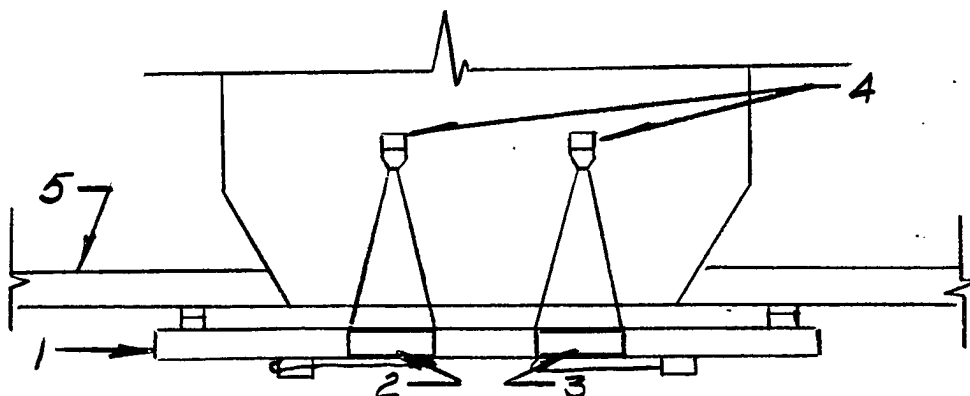
11. Water Station. The water station is a telescoped pole-like bar. It is powered by a salt water activated battery so arranged that when the DMQ-1 box is dropped into the sea, the battery will activate in a period of 7 to 14 minutes and activate a powder-filled squib. Firing of squib permits the telescope tubes to erect so that water recovery might be attempted by the recovery equipped aircraft. This equipment proved unsuccessful and was removed during the latter part of the operation. See Chapter III, Tab "C". (S)



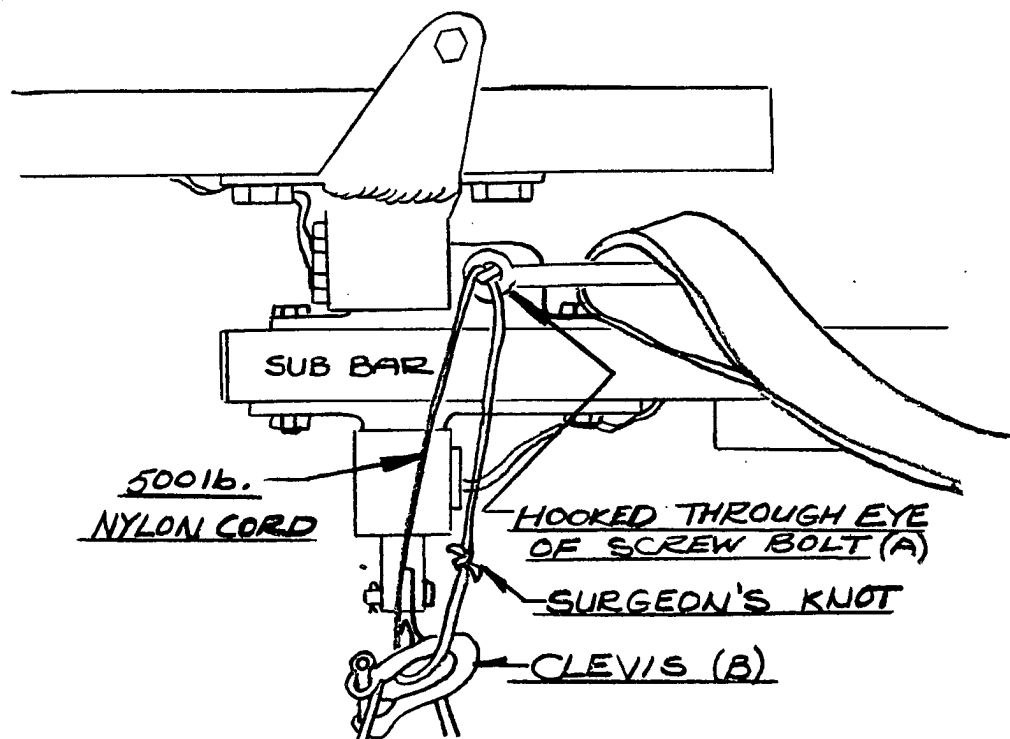
12. Chaff Modification. A box of RR-6 chaff (2) and RR-20 (3) is attached to each side of the sub-bar (1). A wire is placed under the cardboard flaps of the chaff boxes and attached to the D-rings (4) on the sail so that when the sub-bar separates from the main bar (5) the packages are ripped open and the chaff dispersed. This allows ground radar sites to definitely fix the point where the gondola is descending to ground level. See Tab "C", this Chapter. (C)

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13. Snubber Modification. The "snubber" is a length of nylon cord connecting the Electronics box cables to the sub-bar. Upon "dial-down", the gondola descends on a four chute cluster. As the gondola passes through 20,000 feet, a powder-filled squib is blown, causing the electronics box to fall loose from the sub-bar. The box then hangs suspended by the nylon cord. When the recovery aircraft engages the drogue chute of the parachute cluster, the inertia causes the cord to break and allows the electronics



box to fall free. This decrease in weight allows a lighter payload to be drawn into the recovery aircraft. See Tab "C", this Chapter. Retention of the electronics box precludes inadvertent free fall collision with the recovery aircraft, free fall to the surface, and also provides VHF and HF transmissions continuously to the surface. (S)

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14. Electronics Equipment.

a. The operational schedule of the electronic functions to be performed in a normally successful balloon flight of the 119L system follows in sequence. The schedule described is that originally flown starting with the 10 January 1956 flights. (C)

b. Immediately prior to the release of the balloon, the electronics system was made operative by connecting the power plug (P-51) into the suspension system cabling. At this instant the timer motor in the 1B-E5 Control Unit started and continued throughout the entire flight life to operate the cams and odometers. Thereafter, these functions occurred in cyclic or time sequence. (C)

c. The first electronic package device to become operative was the safety circuit, which would blast the ballast hoppers and separate the bars 30 to 40 minutes after balloon release if the balloon lingered below 15,000 feet altitude. An Auxiliary Safety Unit, 2G-B0 (activated only by aneroids to provide safety against free fall of the balloon from high altitudes) was developed but never flown with the system due to discontinuance of the project. (C)

d. The second electronic device to activate was the ballasting circuit, which controls simultaneously the flow of ballast from the two ballast hoppers. This circuit was activated 90 to 100 minutes after launch time. Whenever the balloon was below 40,000 feet mean sea level and descending, this circuit, containing the Auxiliary Ballast Control Unit, would permit the flow of the fine shot from the ballast hoppers. Raising the night floating altitude of the balloon systems would require more time after launch before ballasting should start. Consequently, this circuit would be activated at a later time. Since altitude requirements sensitively affect mission performance, the ballasting circuit setting was made to conform to the particular operational plan and balloon type being launched. (C)

e. Turning on the DMQ-1 mission package was the third electronic device to be activated. This circuit was activated after a time delay which was determined by the Commander, Detachment 1, 1st Air Division, based on trajectory forecast of the balloon flight and limited to avoid photographing a launch site or friendly territory. (TS)

f. Releasing the HF and VHF antennas and providing voltage to operate both radio units was accomplished by activation of the radio control circuit after time delay of 50 to 120 hours after launch time, depending upon launch site location. These times were determined by climatological studies and empirical results of

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balloon travel across the desired mission area. (S)

g. Because radio signals were not being heard upon balloon life termination prior to radio turn on time, the circuit voltage releasing both radio antennas was changed so that antennas would be released upon activation of the ballast circuit. Thus, the antennas were readied for transmission for both terminating and normal operation. In order to insure that the antennas would not be frozen fast in the non-operative position, waste polyethylene was used to cover the HF antenna reel. Waste polyethylene was also used to cover the ballast hoppers to keep the ballast dry. (C)

h. It was necessary to turn off the DMQ-1 equipment prior to the expenditure of the entire roll of film. If it operated without film, so much power would be drawn from the battery that effective operation of the electronics equipment would be endangered. This setting was determined for any particular flight as that for the DMQ-1 time on plus 126 hours. Although this amount of time did not provide complete utilization of the film it safeguarded the battery power supply. Maximum value of the film was later obtained by adding a separate battery to the DMQ-1 package. This modification removed the requirement to turn off the DMQ-1 equipment. (S)

i. In the original electronic equipment arrangement one odometer was carried as spare. Operational experiences indicated that the HF transmission would probably make the balloon system less vulnerable to unfriendly forces if its activation was delayed until near the end of the scheduled flight. For this reason, wiring changes were prepared to provide this facility, while retaining the radio control circuit for turning on only the VHF transceiver; the latter would provide tracking by VHF/DF and cut-down by either aircraft or ground cut-down stations. (TS)

j. The only major modification made in the 1B-E5 Control Unit was to replace one cam with a set for gating voltage to operate the DMQ-1 equipment every 6.25 minutes instead of every 12.5 minutes. Minor wiring modifications were made to improve circuit efficiency by the addition of diodes and suppressing resistors. (C)

k. The only major known malfunction of the electronics package reported re-occurring during the operational period of Project 119L was faulty transmission of the three letter Morse code identifier (call sign signal). Singular cases reported of electronic malfunction were an early antenna release, and erratic identifier cycling. Since recovery of the electronics package in an undamaged condition was extremely difficult, worthwhile evaluation of electronic operations was not made on equipment transiting the mission area. (S)

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15. A breakdown as to the final weights involved in the 119L system follows:

a. 119L system using the 128TT balloon:

(1) Balloon	555 pounds
(2) Load Strap and Safety Chute	28
(3) Rotator	13
(4) Bar and Cluster	129
(5) Electronic Box	175
(6) DMQ-1 Box (Difference due to manufacturer)	406 - 416
(7) Locator Beacon	28
(8) Ballast Hoppers (Empty)	25
(9) Chaff	2
(10) 2 GBO Unit	2
(11) External DMQ-1 Balance Weight	<u>40</u>
Total Gross Weight	1403 - 1413 Pounds

b. 119L system using the 66CT balloon:

(1) Balloon	225 pounds
(2) Load Strap and Safety Chute	25
(3) Rotator	13
(4) Bar and Cluster	129
(5) Electronics Box	175
(6) DMQ-1 Box (Difference due to Manufacturer)	406 - 416
(7) Locator Beacon	28
(8) Ballast Hoppers (Empty)	25

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(9) Chaff	2
(10) 2 GBO Unit	2
(11) External DMQ-1 Balance Weight	<u>40</u>
Total	1070 - 1080 Pounds

c. Pick up weights for 119L system using 1281T and 66CT balloons:

(1) Air:

(a) Cluster	57 Pounds
(b) Small Bar	23
(c) Locator Beacon	28
* (d) Electronics Box	175
(e) DMQ-1 Box	406 - 416
(f) External DMQ-1 Balance Weight	<u>40</u>
* Total Gross Weight	729 - 739 Pounds

(2) Water:

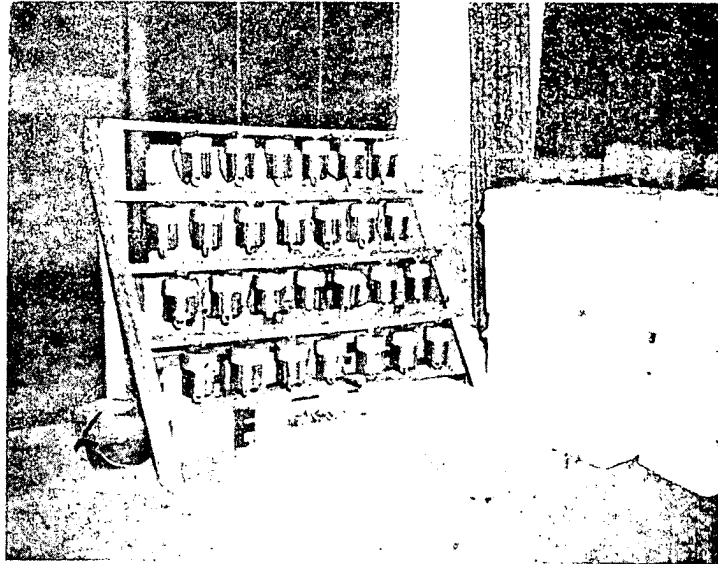
(a) Locator Beacon	28 Pounds
(b) DMQ-1 Box	406 - 416
(c) External DMQ-1 Balance Weight	<u>40</u>
Total Gross Weight	474 - 484 Pounds

* Electronics box should separate upon contact of aircraft pick-up poles with drogue chute. Total gross weight will then be 554 - 564 pounds.

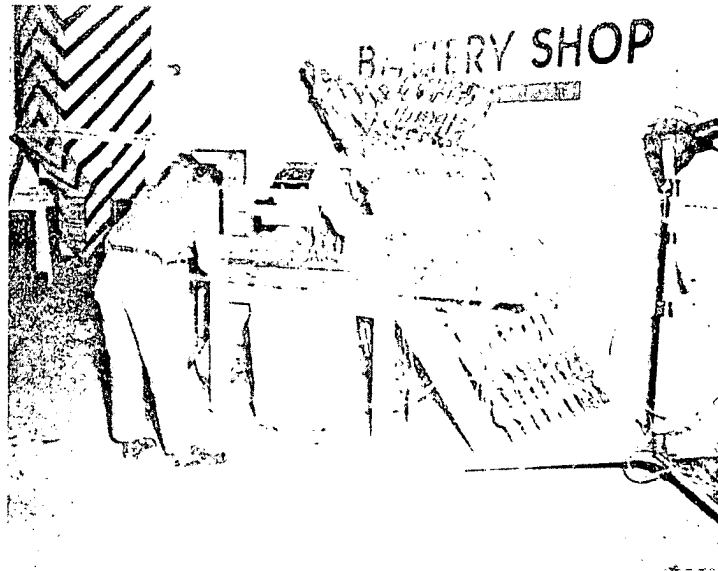
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ASSEMBLY LINE



Prepared Rotator and Ballast Boxes



Prepared Main Bars

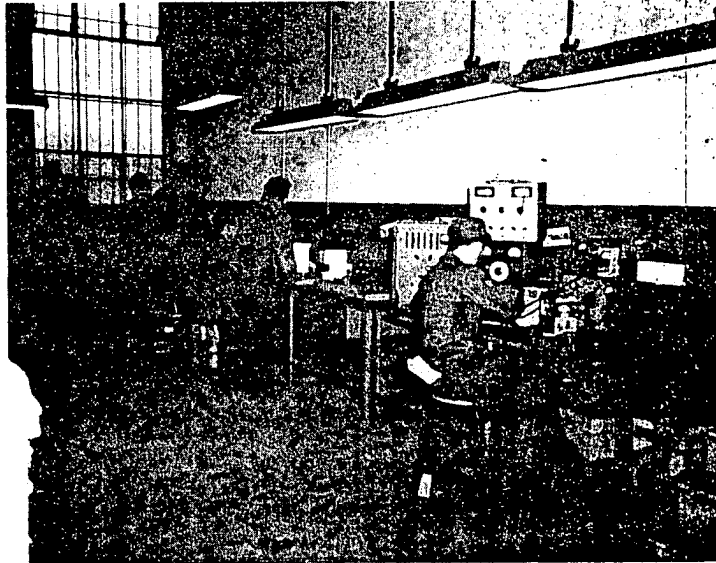
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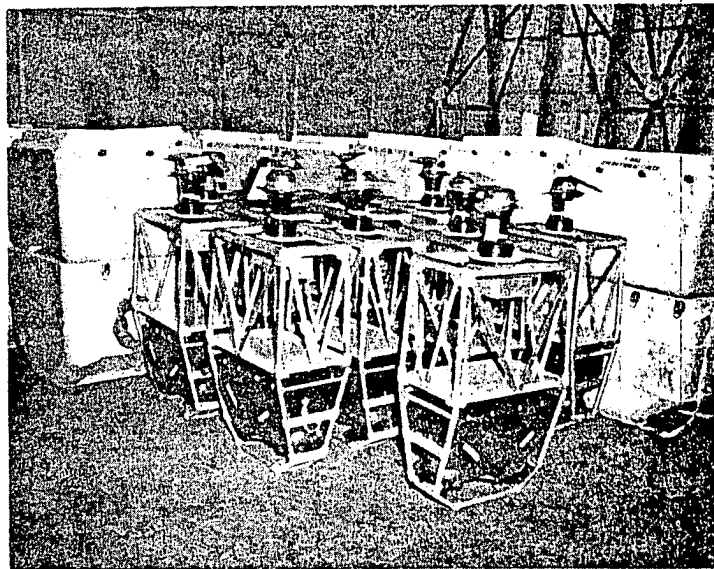
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ASSEMBLY LINE



Test and Assembly - Electronics Shop



DMQ-1 Assembly

Incl 2

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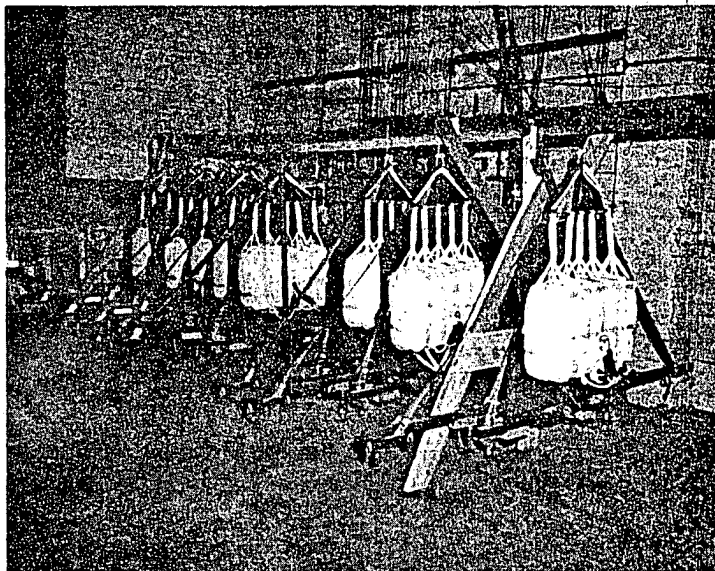
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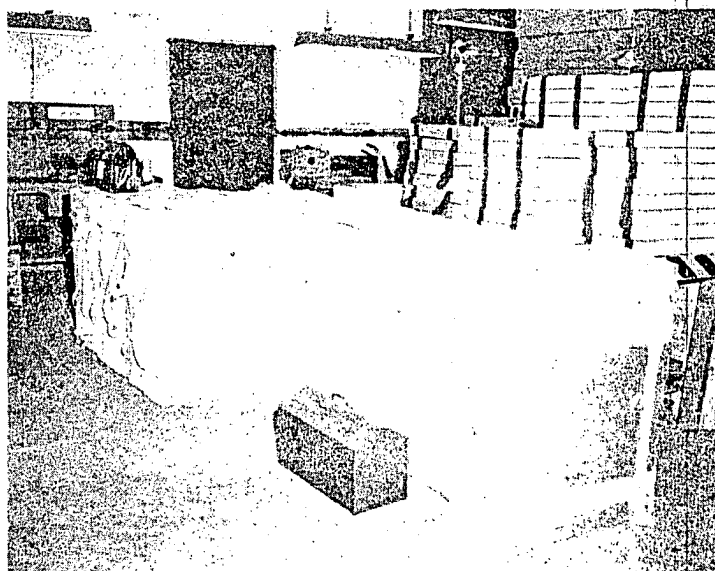
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ASSEMBLY LINE



Parachute Cluster, Main Bar and Sub-Bar



Electronic Packages

Incl 3

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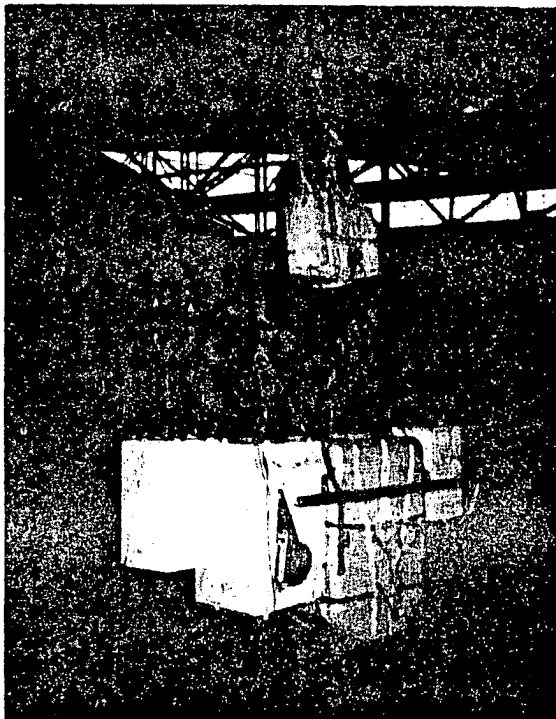
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ASSEMBLY LINE



Completed Gondola

Incl 4

100

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TAB C

FIELD TESTS FOR MODIFICATION

TC SYSTEM 119L

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I. FIELD TESTS FOR MODIFICATIONS TO SYSTEM 119L

A. Safety Chute:

1. A 64 foot cargo parachute had been the necessary safety device in the balloon system during the Zone of Interior Service Test of Weapons System 119L. In addition, the vehicle had been instrumented to automatically terminate flight (with gondola descent by system chute cluster), should ascent above 28,000 feet not occur within 100 minutes after launch release or should the vehicle descend below the altitude of 28,000 feet after gaining initial floating altitude. The 64 foot parachute was attached primarily to minimize ground damage to personnel or property if the balloon failed, either by rupture or development into a leaker. (U)

2. The operational system was programmed to fly without a safety chute. The requirement for such a feature was not evident when the equipment design was decided upon as it was not anticipated that many balloon ruptures would occur. Moreover, it was believed in 1954 that it was neither necessary nor desirable to lower the payload on a parachute when a burst did occur. Since our launch sites in Germany were located in densely populated areas and Evanton and Gardermoen in moderately populated areas, it was known that local civil population would react unfavorably to damage by falling objects. If reasonable precautions were taken to minimize the risk to life and property, it was believed that any situation arising with regards to property damage or personnel injury could be met on firm ground. Without a safety device there would be no recourse but to accept the criticism, regardless of how severe it might be. (TS)

3. With the above in mind, an immediate test program was initiated, in cooperation with Wright Air Development Center, to arrive at a satisfactory solution to the problem. A sufficient quantity of 64 foot chutes did not exist in Air Force stock. The Department of the Army had the necessary quantity; however, monetary compensation would be necessary in the amount of over 1 million dollars. A check disclosed a plentiful quantity of overage 24 foot personnel chutes in Air Force stock. Using this 24 foot chute, extensive tests were made at Wright Air Force Base, El Centro Naval Air Station and Edwards Air Force Base. Chutes were subjected to destruction tests to obtain the material strength data. They were then dropped with an 1,300 pound weight from heights of 1,000 to 43,000 feet. From these tests it was concluded that the 24 foot, flat, overage, personnel chute would withstand the opening shock and rate of descent from any altitude. Air Force Cambridge Research Center had also started an extensive testing program into the

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development of a mechanical safety device (2G-B0) and determined that a collision between the single chute and chute cluster could be expected if bar separation occurred, since in the early part of the descent the single chute would fall more rapidly than the cluster. The solution to this was to rig the single chute with an unsymmetrical riser to make it slip sideways during descent. Tests determined that sufficient slip could be produced, while the single-chute was catching up with the cluster, to avoid a tangling collision. (C)

4. The addition of the slipping safety chute was readily accomplished by the detachments in the field. After the start of actual operations, reports from the field indicated that this emergency safety modification was performing satisfactorily. Statistics as to rates of descent are contained in Tab "A", this Chapter. (C)

B. Snubber Modification:

1. The original 119L system was designed so that after an initiated "cut-down", and as the sub-pole descended on the chute cluster, both transmitters would provide signals for direction finding equipment. If the sub-pole, loaded with the DMQ-1 and thermal box, had not been air recovered before descending to a pre-set height (i.e. 2,000 feet) a squib would explode, releasing the thermal box which would free fall. Apprehension had grown in the 456th Troop Carrier Wing that the basic principles listed above might not be too desirable. The increased air-to-air pick-up weight, due to the presence of the thermal box on the sub-pole, reduced the possibility of a successful air recovery. If the thermal box was set to separate from the system at a high altitude (i.e. 20,000 feet), transmission of termination signals and determination of geographical position where termination occurred would not be possible. There would also exist a possibility of damage to a lower flying aircraft by a free-falling object. (S)

2. A study and various tests were made by 1st Air Division with the approach that any modification must be of a simple nature and one that could readily be made in the field. A solution was arrived at and consisted of setting the thermal package squib to activate at 20,000 feet. A "snubber", which in reality was a length of 550 pound test nylon shroud line, connected the thermal package cables to the sub-pole. This cord was tightly tied to the eye of the screw bolt in the sub-pole and to a standard clevis pin, which was connected to the wire supporting cables on one side of the thermal package. (See Tab "B", this Chapter) Upon "dial down", the gondola would descend on the chute cluster. As the gondola passed

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through 20,000 feet, a squib was activated, causing the thermal box to mechanically release from the sub-pole, but remain suspended by the nylon "snubber". When the recovery aircraft engaged the drogue chute of the parachute cluster, inertia caused the "snubber" cord to break and allowed the thermal box to release. A lighter payload could then be drawn into the aircraft. (S)

3. Reports from the field indicated that the modification worked as planned. (U)

C. Water Station Modification:

1. On 3 December 1955, tests conducted by Air Force Cambridge Research Center disclosed that the water station batteries (XCRC-1A), which provided power for extension of the station upon water landing, were not adequate from a voltage output standpoint. Procurement of a new type battery was initiated and, as an interim measure, it was determined that if 2 XCRC-1A batteries were wired and mounted in parallel, they would suffice. In addition, one water station mast was jammed upon activation. This malfunction was corrected by increasing the length of the bolt at the water station mast. (C)

2. When the first systems were terminated in the recovery area, it was reported that the water station mast was failing to extend on those packages floating in the sea. At approximately the same time, an instance of personal injury to a friendly foreign national due to the explosion of a water station powder filled squib was reported to this headquarters. It had been determined that air-to-water pick-up was impractical with the equipment available. In addition, the water station was a dipole of the token radar which it was believed contributed to the radar return of the balloon system. All water stations were immediately de-activated and the deployment bag and pick-up rope removed from the system. The inactive water station was retained on the DMQ-1 package so that the center of gravity would be such that the box would float in the proper position to allow the locator beacon to function. (C)

3. It was believed desirable to remove the inactivated water station from the package. Tests were immediately made by a detachment in the field to determine the proper rigging of a package without water station attached. Air Force Cambridge Research Center advised that the station could be removed; however, a balance weight would have to be added so as to assure the proper floating position. After extensive practical tests, during which

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time fully equipped packages of operational configuration were dropped from realistic heights to simulate water landings, an interim measure was adopted for the elimination of the water station. This method consisted of utilizing the pick-up rope deployment bag and filling it with 40 pounds of steel dust ballast. The bag was mounted on the same side as the locator beacon battery, positioned in the lower right hand corner and extended around the narrow side of the package. To obtain proper package leveling, it was necessary to jar and then re-level the package several times until jarring no longer created package unbalance. (C)

4. This modification was never placed into effect on operational units due to the stand-down of operations on 6 February 1956. (S)

D. Safety Parachute Restraining Cord:

1. Because the wind in a normal layout was directed into the bottom of the 24 foot safety chute, the chute billowed when balloon inflation operations were underway. (U)

2. This difficulty was avoided by tying the open end of the chute canopy during inflation with a loop of light break cord. To this cord and the front bumper of the Fisher Launcher was tied a length of 1500 pound test nylon braided cord. Upon release of the balloon from the launch platform the restraining cord was broken manually after the chute had risen well out of the forward view of the person driving the release vehicle. (C)

E. Chaff Modification:

1. Acting upon a recommendation from Strategic Air Command Victor, a method by which determination of the location where air separation of the bars occurred was devised. It was visualized that all radar sites would continually be monitoring the surrounding area and that any unidentified target would be immediately fixed. The reflecting target afforded by 119L system might not be enough; however, if chaff were dispersed then a large and lingering target would be made available for radar sighting. For this purpose, a box of RR-6 and RR-20 chaff was attached on each side and at each end of the sub-pole. Wires were placed under the cardboard flaps of the chaff boxes and attached to the D-rings of the sail and under the sub-pole so that any time the sub-pole separated from the main pole, the boxes were ripped open and chaff dispersed. (C)

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2. This modification proved very satisfactory as reports from both the launch and recovery areas indicated. Many failures were immediately identified as such by the dispersment of chaff. This modification also proved of value in the recovery area by permitting radar fixing of downed packages. (S)

F. Locator Beacon:

1. Early in May 1955, it was determined that a requirement existed to obtain a locator beacon transmitter which could be attached to the gondola and aid in the locating or relocating of downed gondolas that could not be air recovered after flight termination. The resources of the armed forces were explored to determine if a device was available to meet this requirement. The general specifications of the device required were as follows: (S)

a. The device should be capable of operating on land or in water. (U)

b. Device should transmit on a frequency between 225 and 400 MC in order to work with UHF homing equipment (C-119 aircraft of the 456th Troop Carrier Wing as well as the SA-16 aircraft of Air Rescue Service are so equipped). (C)

c. The device should be as light as possible, not to exceed 40 pounds total weight. (U)

d. Planned utilization was to carry one on each balloon; in addition, it would be **desirable** if the device could be dropped from aircraft in flight to mark downed packages. (C)

e. The transmitter should not be activated until the package **was** dropped on land or in the water. (U)

f. The transmitted signal could be either continuous or intermittent, but should have a life of at least 24 hours. (U)

2. In establishing the operating frequency of the beacon, radar, HF, VHF, and UHF were considered. Radar was discounted due to limited range, power requirements, and extensive sea return. HF was discounted due to the requirement for a lengthy antenna. VHF was discounted because it would have required an extensive retrofit program to equip the 456th Troop Carrier Wing aircraft with proper homing equipment. UHF was selected based on the following: (C)

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a. Moderate ranges could be expected with little power (100 miles with 3 watts). (U)

b. No lengthy antenna requirements. (U)

c. Aircraft of the 456th Troop Carrier Wing and all SA-16 aircraft of Air Rescue Service were equipped with UHF homing equipment. (U)

3. In view of the fact no equipment was currently available to meet this requirement, a contract was let to develop and produce a suitable item. To assist the manufacturer in the development of an appropriate item, and to determine its operational feasibility prior to first article approval, this headquarters instituted a test program. The program included parachute drops of the 119L gondola in the ocean with the beacon attached and homing tests by aircraft. The first test was scheduled at Charleston Air Force Base, South Carolina, on 30 August 1955; however, the manufacturer could not produce an item and the test was cancelled. The test was rescheduled on 8 September 1955. A beacon was available for this test; however, it malfunctioned shortly after being activated. Based on the results of this test, the manufacturer completely redesigned the beacon, changing many of the circuits and components. A third test was cancelled because the manufacturer had not completed the redesign of the beacon. The final test was conducted at March Air Force Base, California, on 3 October 1955. Four gondolas with beacons attached were air dropped in the ocean off Catalina Island. The parachute systems on all four gondolas failed to deploy and the gondolas free fell approximately 3,000 feet. Of the four packages which landed in the water, only one functioned properly. Homing runs at various altitudes were then performed on other beacons which were placed in the water. A maximum range of approximately 115 miles was obtained at 17,000 feet. Three types of aircraft were used during this test; a KC-97, SA-16, and a C-119, operating at the intermediate and lower altitudes. All aircraft were able to home on the beacon and locate the gondola. (C)

4. The final product had the following characteristics:

a. Operated on a frequency of 242.8 MC, and was compatible with UHF aircraft homing equipment. (U)

b. Weighed less than 40 pounds. (U)

c. Transmitter did not commence operation until immersed in sea water only. (C)

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d. Operated on a frequency of 1 minute on and 4 minutes off for a minimum of 48 hours. (U)

e. Power output of 3 watts with an effective range of approximately 100 miles. (C)

5. During the operation, 5 of the 23 beacons which landed in the water functioned properly, and an additional one operated for only two hours. In order to determine the reasons for malfunction of the beacons the recovered beacons, both from systems that traversed the desired area and from those systems that failed on ascent, were returned to the manufacturer for extensive laboratory tests. Many of the beacons and batteries returned were found to be in good working condition once the batteries were immersed in salt water; however, the battery must remain submerged in order to function properly. The battery is ruined if removed from the water for even a few minutes. From the results of the manufacturers tests it was believed that beacon failure was probably due to the DMQ-1 package not assuming the correct floating position upon immersion in the ocean. (C)

6. An intensive testing program was immediately initiated in the field to discover a suitable solution to the malfunctioning beacon problem. As a temporary measure, one launch detachment was ordered to remove the water station from the DMQ-1 box and install an extra locator beacon and battery. It was believed that this action would possibly allow a beacon to be activated no matter which side was immersed in the water. Only five (5) systems were launched before the operations ceased. Of these five systems, none reached the desired recovery area. (S)

7. Air Force Cambridge Research Center was requested to perform floating position tests on the DMQ-1 box. The test packages were of operational configuration and had the inactivated water station removed. Test packages were rigged with various type balance weights and dropped from realistic heights. Air Force Cambridge Research Center's recommendations were immediately forwarded to the field for testing on operational units. (C)

8. Again, operational packages were rigged and dropped from realistic heights. It was ascertained that the addition of a 40 pound weight to the lower corner of the DMQ-1 box would assure the package correctly repositioned itself after a water landing. This modification was never employed operationally due to discontinuance of the project. (C)

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9. During launch operations, four beacon antennas ejected from the beacon case, rendering the beacons inoperative. In addition, one antenna was reported to have ejected while in storage. Based on the reports received from the 1110th Air Support Group, it appeared that the plastic holder, located at the base of the antenna when in its extended position, may have been faulty in these five units. This problem was also referred to the manufacturer.

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TAB D

LAUNCH OPERATIONS

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I. LAUNCH OPERATIONS

A. The 1110th Air Support Group was located at High Wycombe, England and directed the activities of five launch detachments which were located as follows: (TS)

1. Detachment 1 - Oberpfaffenhofen, Germany
2. Detachment 2 - Adana, Turkey
3. Detachment 3 - Gardermoen, Norway
4. Detachment 4 - Evanton, Scotland
5. Detachment 5 - Giebelstadt, Germany

B. The sites were chosen so as to provide maximum photographic coverage of the Russian and satellite territories. Choice was based on best estimates of upper air trajectories over the target area, surface weather, political considerations and dispersal. With the exception of Gardermoen and Adana, all sites were inactive or semi-inactive air bases where launch operations could be conducted with minimum restriction and interruption. Each base had adequate covered storage, personnel housing, shop space and hard surface launch area. (TS)

C. The primary mission as outlined in 1st Air Division Operations Order 250-55 was executed 10 January 1956. Headquarters United States Air Force restricted maximum altitude of balloons to 55,000 feet and restricted the total effective (presumed successful) number of balloons to be launched during any 24 hour GMT day as follows: (TS)

1. 10 January through 16 January 1956 - 10 Balloons.
2. 17 January through 24 January 1956 - 20 Balloons.
3. 25 January through 27 January 1956 - 30 Balloons.
4. 28 January to termination - 40 Balloons.

D. In general, the weapons system, developed through the Operational Suitability Test "Moby Dick Hi" was similar to that flown during the primary mission. Deficiencies were encountered prior to launch operations and resolved by system modifications as noted in previous parts of this report. In addition, the actual operation revealed the necessity for other changes detailed below. (S)

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1. It was originally planned to utilize a 25 $\frac{1}{2}$ foot load strap connecting the balloon to the gondola. Upon testing, it was determined that the end of the 128TT balloon would be 10 inches from the cradle of the Fisher Launcher and could possible sustain fabric damage during cross wind launches. A 25 foot extension, consisting of 10,000 pound test nylon coreless cord-
ing, was attached between the standard load strap and the gondola. This made it possible to maintain the balloon train on as near as possible a horizontal plane to insure accurate scale readings and facilitate launch release. Since the smaller 66CT balloon had been added to the weapons system as an alternate vehicle, it was also necessary to increase its train by the addition of a 75 foot, 10,000 pound test nylon coreless cording, extension. This extension was connected in the same manner described above. (S)

2. The proper leveling of the fiberglass box prior to flight and the assurance that any out of level conditions during flight is at a minimum **are** very critical. The mounting and installation of the water station and locator beacon with battery on the original harness and cable suspension system of the fiberglass box unbalanced the assembly to such a degree as to eliminate the possibility of re-balancing the leveling. To overcome this difficulty and to allow for further adjustment to balance for true level, three turnbuckle barrels on the original assembly were replaced with three new turnbuckle barrels which were 1 $\frac{3}{4}$ inches longer and allowed greater adjustment. The turnbuckle barrels replaced were those three which were located on the side of the harness or box farthest away from that side upon which the water station and locator beacon power pack were mounted. (C)

3. During tests conducted by Air Force Cambridge Research Center, there was an indication that during inactive storage the probability existed of partial activation of the XCRC-1A delay battery used to cause erection of the water station. Partial activation of these batteries would affect their efficiency in electrical current output during use. It was therefore decided to connect 2 XCRC-1A batteries in parallel. Tests satisfactorily indicated that this system would produce more than sufficient electrical current needed to fire the S-63 squib. Immediate procurement action was initiated to obtain a new improved water activated battery that would perform the necessary function. (C)

4. Exposure time of system cameras was changed from the originally established 12 $\frac{1}{2}$ minutes to 6 $\frac{1}{4}$ minutes to provide continuous overlapping photo coverage when operating at lower altitudes and higher ground speeds. (S)

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5. Operation of the cameras was changed from the original 24 hour continuous system to a daylight only system, since results obtained from night operation during the Moby Dick Hi Operational Suitability Test were nil. This provided a greater yield in terms of footage of film expended and useable frames obtained, and also provided additional film supply for increased rate of film consumption. (See paragraph 4 above). (S)

6. An additional power source was added to the DMQ-1 package. This was to insure that in case of continuous camera cycling, due to either a malfunction or film supply expenditure, the resultant power drain would not be from the 119L system electrical power source. This modification was not made to packages flying Bill Jack cameras as a difference in camera design made it unnecessary. (S)

E. Initially all balloons were launched with a recommended 7% free lift so as to preclude underinflation. Actual free lift was ascertained from the lowest reading of the scale located on the launch platform. Other operational criteria for initial launch operation were as follows: (C)

1. 66CT:

a. Evanton - Initial floating altitude 45,300 feet with a night floating altitude of 40,000 feet and ballast for 7½ days. (S)

b. Oberpfaffenhofen, Giebelstadt and Gardermoen - Initial floating altitude of 46,400 feet with a night floating altitude of 40,000 feet and ballast for 7 days. (TS)

c. Adana - Initial altitude of 46,400 feet with night floating altitude of 40,000 feet and ballast for 7 days. (TS)

2. 128TT:

a. All launch sites - Initial floating altitude of 50,000 feet with a night floating altitude of 45,000 feet and ballast for 8 days. (S)

3. A cartoon placard, multi-language placard and Russian language placard were affixed to the camera package. The Russian language placard was affixed on 23 January 1956, 13 days subsequent to mission execution. (TS)

4. The top half of each of the wide sides of the camera package were painted with international orange paint. (U)

5. The line numbers used to identify the instrumentation of the individual package (see 1st Air Division Manual 55-9)

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were painted on the upper half and lower half of the camera package. (C)

6. Camera turn-on time was determined by the Launch Control Center, High Wycombe, England, based on forecasted penetration. However, every reasonable effort was extended to avoid photographing friendly areas. In no case was the camera turn-on time to be such as to photograph the immediate launch area and permit identification of the launch site. (TS)

7. Balloon launches were not scheduled when forecast trajectories indicated a return to the European area or excessive flight time prior to penetration of the target area. It was directed that launches would be accomplished if forecast trajectories indicated penetration of meridian 45E within the time periods indicated for sites as follows: (TS)

a. Oberpfaffenhofen	-	60 hours	
b. Adana	-	24 hours	
c. Gardermoen	-	48 hours	
d. Evanton	-	72 hours	
e. Giebelstadt	-	60 hours	(TS)

8. HF and VHF radio-on time specified for each launch was as follows: (TS)

a. Standard Setting:			
(1) Germany sites	-	80 hours	
(2) Adana	-	50 hours	
(3) Gardermoen	-	84 hours	
(4) Evanton	-	90 hours	(TS)

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9. Balloons which failed during ascent or at altitude and descended within friendly borders were recovered by United States Air Force in Europe units under instructions contained in the United States Air Force Stray Recovery Plan. (S)

10. Balloon ascent and flight at floating altitude was monitored by MSQ-2 radar, radiosonde, theodolite and visual means. (S)

11. The two German sites and Gardermoen were located in close proximity to unfriendly borders. 66CT balloons were launched from these sites so as to penetrate the target area during hours of darkness (or in daylight if above 48,000 feet), since the initial altitude of this balloon was approximately 46,000 feet. (TS)

12. Based on expected success rates due to trajectories, priority for launching by site was established as follows: (TS)

- a. Priority 1 - Gardermoen
- b. Priority 2 - Giebelstadt and Oberpfaffenhofen
- c. Priority 3 - Adana
- d. Priority 4 - Evanton (TS)

F. After the start of the operation, it became evident that, to accomplish our primary mission, an intensive program of system refinement was necessary. The many problems that arose through restrictions to launch operations from the standpoint of weather, civil reactions and system malfunctions necessitated field test, (which are discussed in detail under Tab "C"), and changes to our original launch criteria. A brief summary of these actions are as follows: (S)

1. With a late start in actual operations, it was readily discerned that immediate advantage would have to be taken of any favorable trajectories. It was decided to waive the previous policy of restricting launches whenever unfavorable surface conditions were prevalent, therefore balloons were launched successfully during ground fog or light icing conditions, but not heavy precipitation. Due to the civil situation existing in Norway, a special set of launch restrictions was placed on the Gardermoen detachment. (S)

2. In consonance with Moby Dick Hi findings and after an adequate sampling had been obtained during the primary mission, it was determined that balloons with serial numbers of

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949 and below would produce an unacceptably high failure rate. Therefore, it was directed that only 128TT balloons with serial numbers of 950 and above would be launched. All 128TT's with serial numbers of 949 and below were set aside. (S)

3. After 21 days of operation, it was believed that excessive losses were attributable in part to the capability of unfriendly forces to track the balloons through their HF transmissions. Consequently, on 31 January 1956, twelve hours were added, and on 3 February 1956, eighteen hours more were added to the radio turn-on times for all sites, except Adana. (See paragraph IC3 Tab F, Chapter III) As of the stand-down date of 6 February 1956, radio turn-on times were as follows: (TS)

a. Germany sites	-	110 hours
b. Adana	-	50 hours
c. Gardermoen	-	114 hours
d. Evanton	-	120 hours

To deny tracking of balloons by unfriendly forces, a few balloons were launched from Adana with the HF transmitter silent. VHF turn-on was based on the established time settings outlined above. Results were inconclusive, however, if operations were renewed, it was desired to fly all systems with silent HF until the final day of expected life (i.e., 5, 7, $7\frac{1}{2}$, or 8 days).

4. Reports arriving from the recovery area indicated that the water stations and locator beacons were not functioning as anticipated. The failure of the water station, coupled with a report of personnel injury by the explosion of a portion of one of the downed gondolas, resulted in the immediate deactivation of all water stations. Since the water station was deactivated, a test program was immediately initiated to determine if the water station could be removed without influencing the water floating position of the DMQ-1 package. In the interim period, the water station was left attached to all gondolas but was deactivated and had the squib, deployment bag, and pickup rope deleted from the system. (S)

5. Subsequently, as a result of specific testing in the field, it was determined that some of our previous launch criteria would have to be amended as follows: (U)

a. 128TT - Free lift, formerly 7%, was changed to a minimum of 5% and a maximum of 10%. Desired free lift was 7 percent. This insured that balloons would ascend under adverse weather conditions, cover personnel computation errors and still

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not endanger the balloon. (C)

b. 66CT - Free lift, formerly 7%, was changed to a minimum of 7% and a maximum of 15%. Desired free lift was 10%. This insured same advantage as for 128TT's. (C)

c. Adana - Initial altitude of 49,000 feet with night floating altitude of 44,000 feet and ballast for 5 days. (TS)

d. 128TT: All Launch Sites - The initial altitude was changed to 54,000 feet and the night floating altitude to 50,000 feet. If operations were renewed after launches were terminated by directive on the 6th of February 1956, it was desired that these balloons be flown with initial altitudes of 60,000 and 76,000 feet with a night floating altitude of 55,000 feet. (See Chapter I, paragraph V F2.) (S)

G. Inclosures 1 through 5 contained in this Tab depict the locations where the balloons that failed upon ascent or soon after attaining floating altitude were recovered. Inclosure 6 this Tab, depicts the locations where the balloons that accomplished successful flight without known penetration of the target area were recovered. (S)

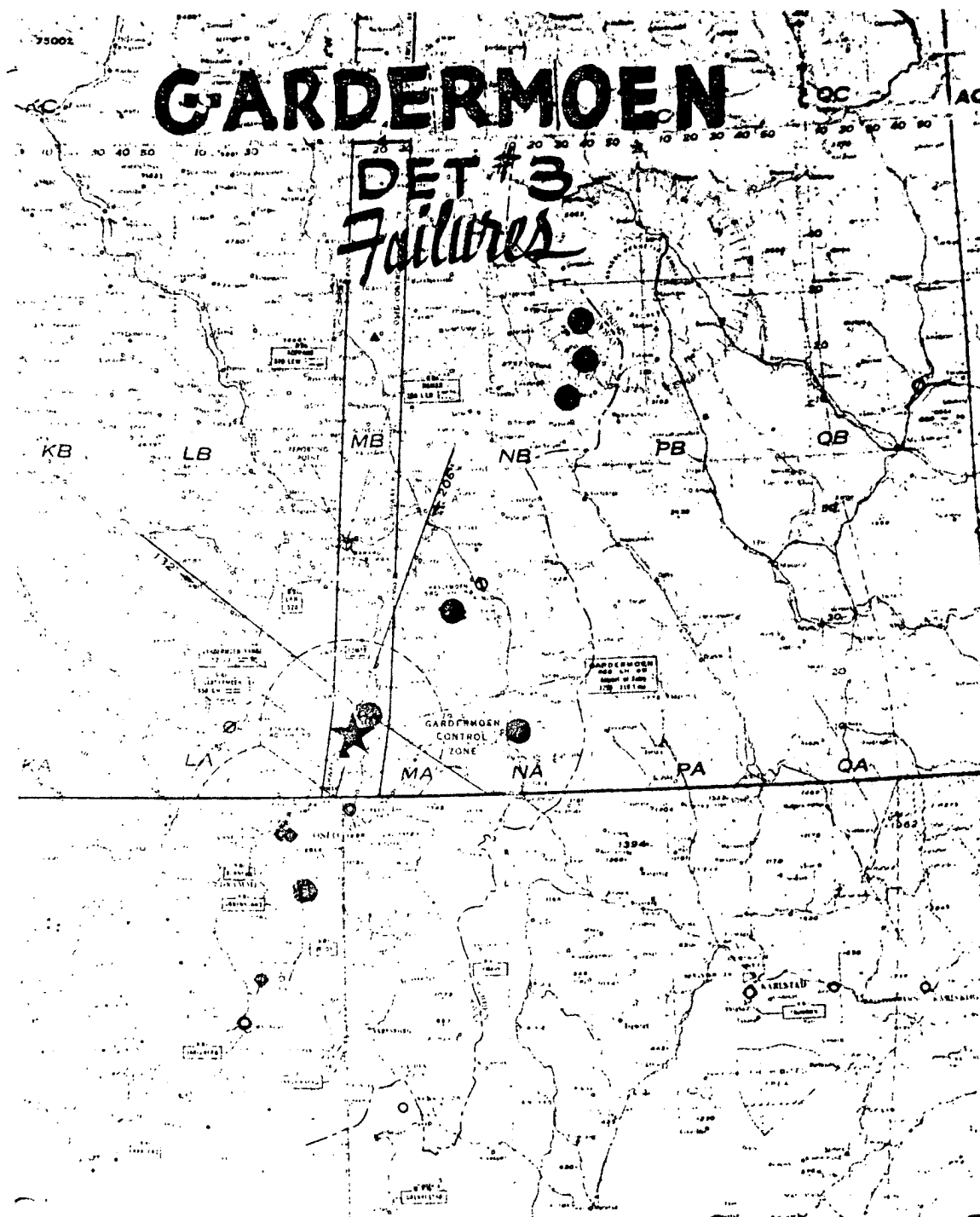
H. Conclusions:

1. The delay in commencing the operation (from 1 December 1955 to 10 January 1956) compressed the project, time-wise, to within a very short period of favorable winds. This, together with a restricted launch rate may have precluded launch of the total 2,500 systems during conditions of most favorable winds if the project had been continued. (S)

2. Deficient polyethelyne and manufacturing defects caused a deficit of approximately 700 balloons in the operational inventory. (C)

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LOCATION WHERE KNOWN FAILURES WERE RECOVERED

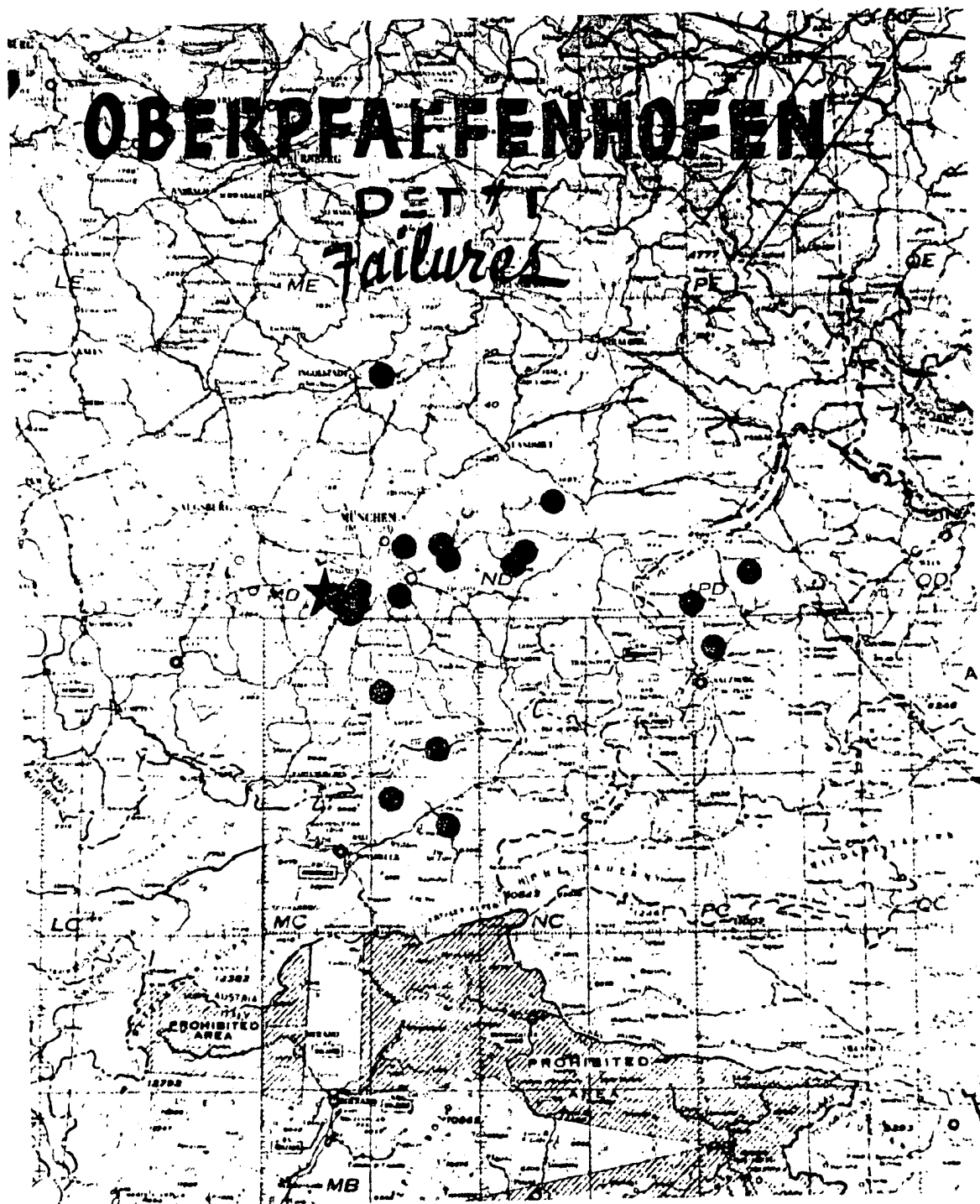
Incl 1

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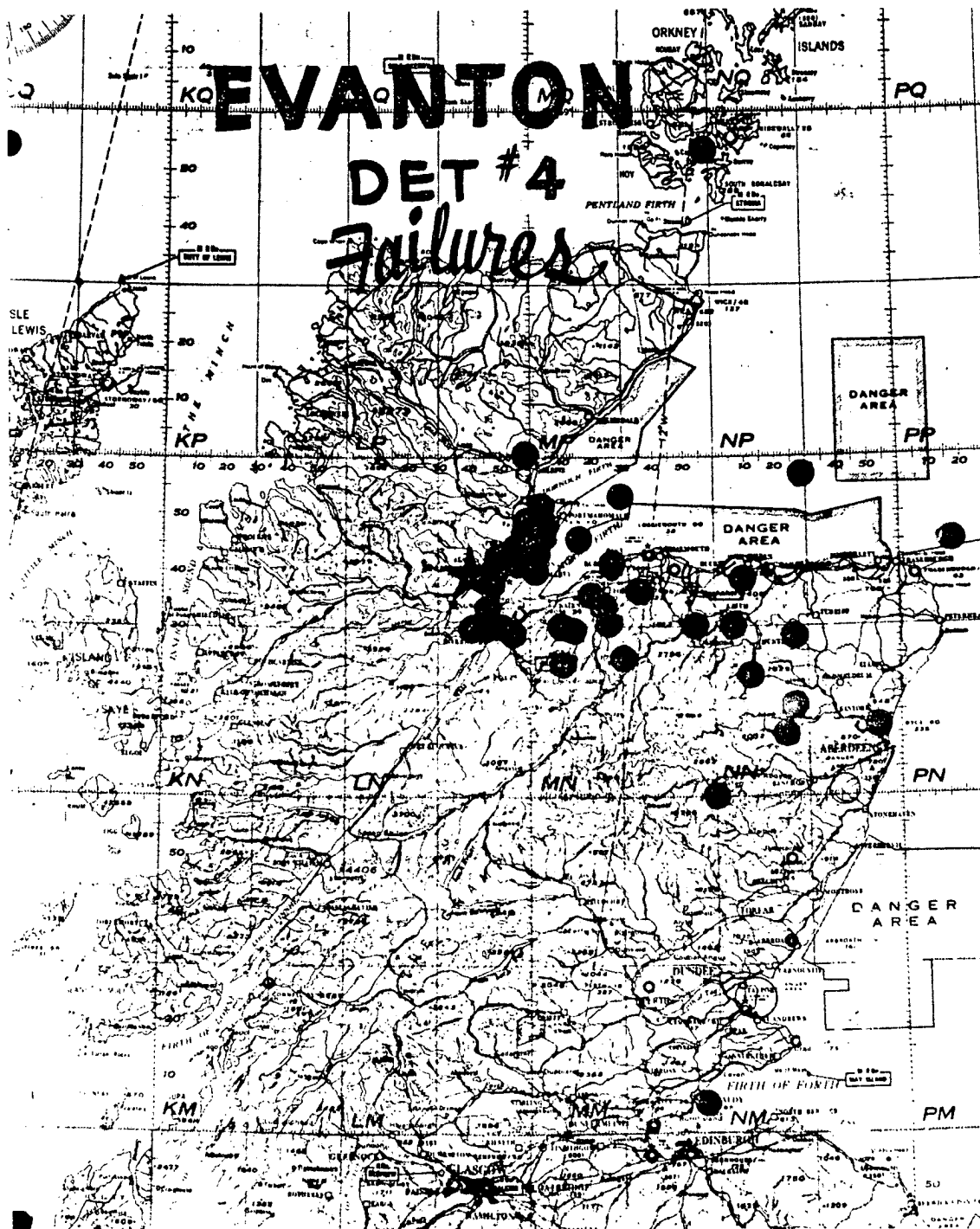
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Incl 3

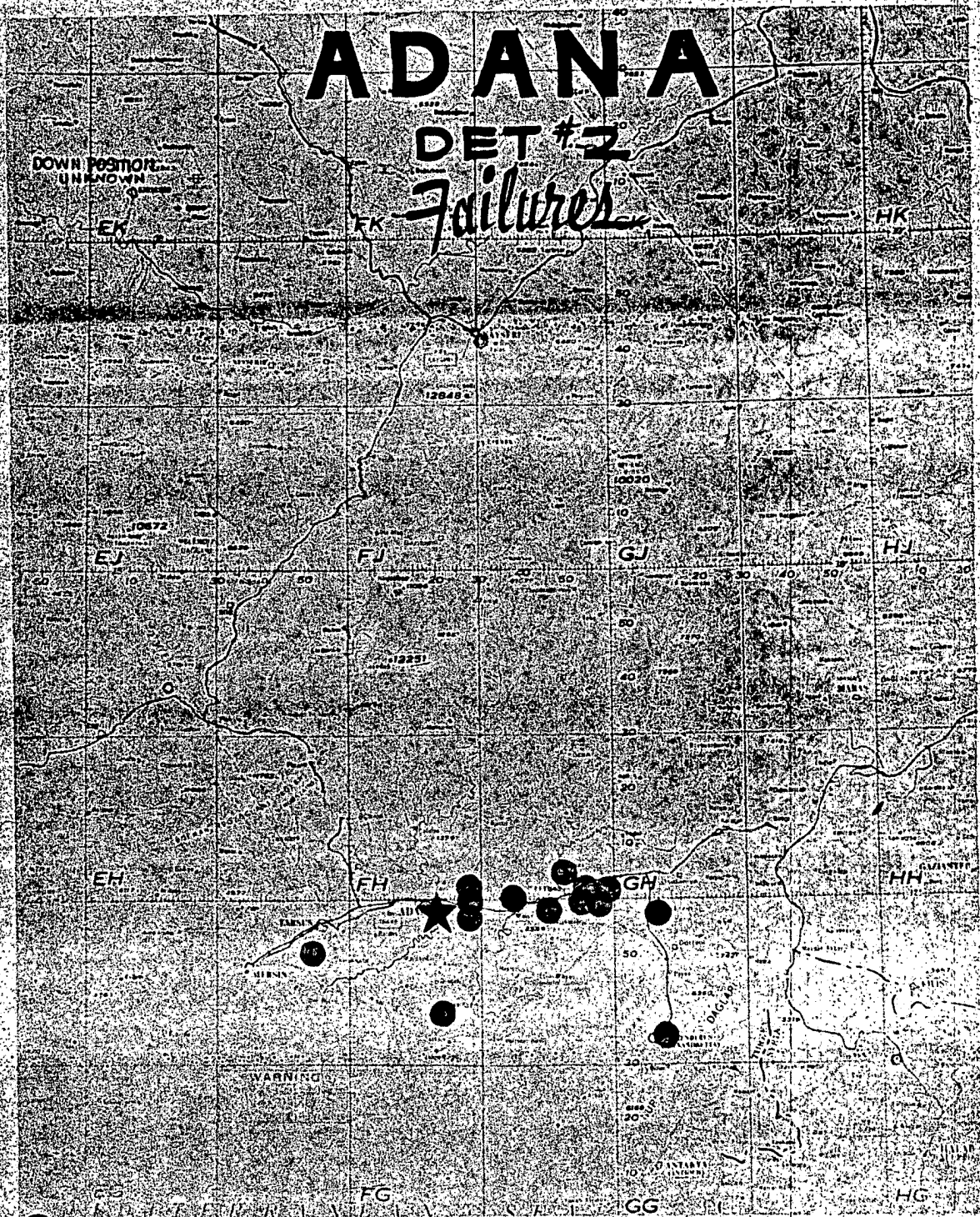
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LOCATION WHERE KNOWN FAILURES WERE RECOVERED

Incl 4

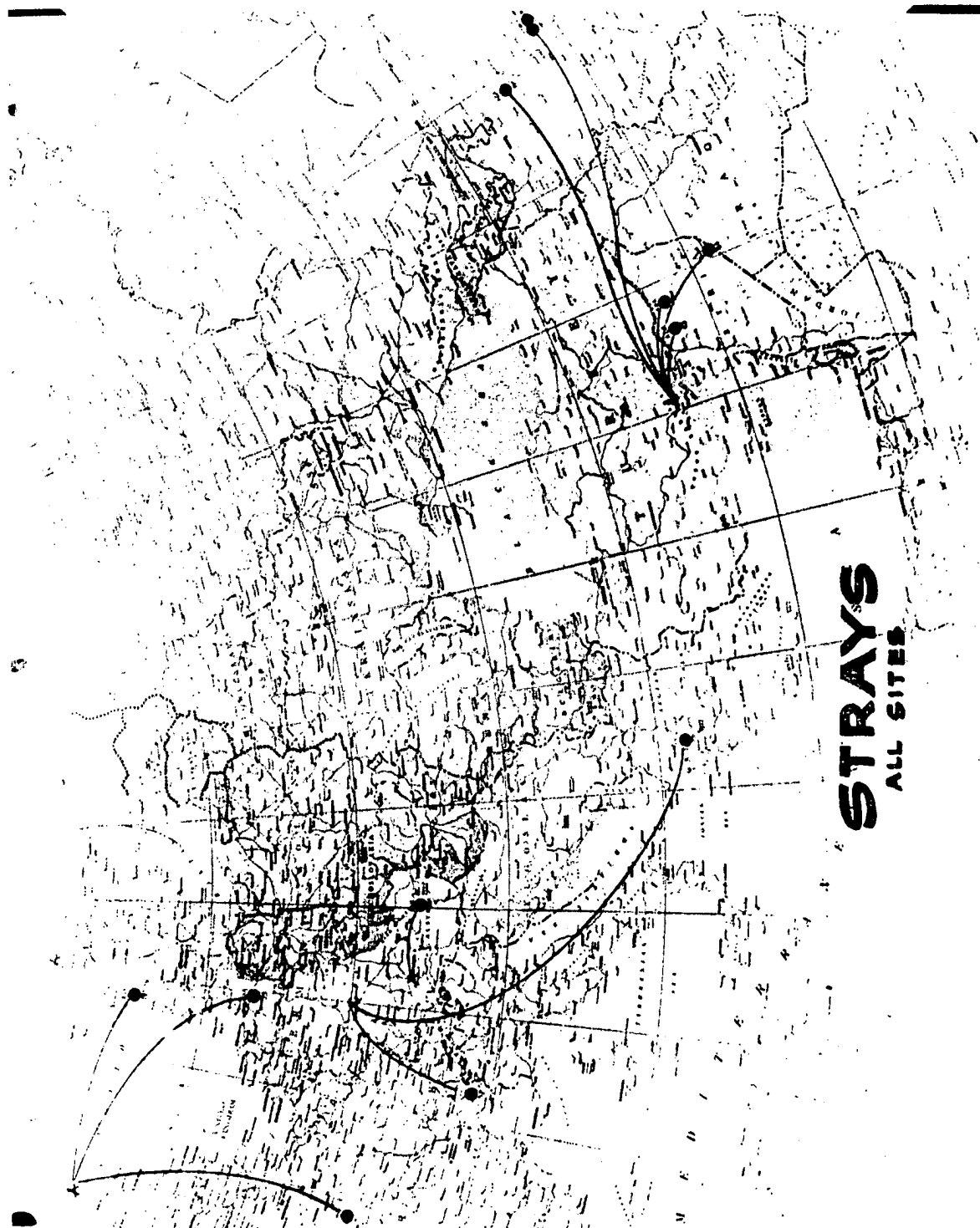
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LOCATIONS WHERE SUCCESSFUL LAUNCHES WERE LATER RECOVERED

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TAB E

HYDROGEN GENERATION

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I. HYDROGEN GENERATION:

A. In every respect, gas generation for the project was completely satisfactory as to quantity, timeliness, and quality. True, there were several unsatisfactory situations encountered during the course of the project, but none were attributable to inadequacies of equipment, either design or manufacture. The training of personnel, by Air Training Command at Francis F. Warren Air Force Base, Wyoming, was completely adequate to enable personnel to set up the generation sites and to produce gas as required. Sites for the project were established with manifolded generators, compressors and electrical generators, and with firm maintenance and inspection scheduling as determined necessary during Moby Dick Hi. Since each site was equipped with 4 each gas generators, compressors and electrical generators, the maintenance plan was to have 1 of each piece equipment stood down for inspection or repair, with the remaining 3 in operation or on standby. This basic plan was entirely adequate. Except for short periods for minor repair, only two sites of the five ever dropped below 75% equipment in commission. (U)

B. The most severe problem encountered was the effect of extreme cold on the gas generators. (As low as - 25 degrees F) At Gardermoen an unforecasted drop to - 10°F caused the freezing and bursting of coils in the cooling water system of one generator. With much difficulty, the coils were locally repaired, having been out of commission from about 2 January until 6 February 1956. At Oberpfaffenhofen, all four generators were completely shut down for approximately 7 days due to temperatures down to -25°F. Prior to start of the project on 10 January 1956, the experience at Gardermoen resulted in adopting two new operating procedures:

1. Maintaining gas generators on "trickle" status.
2. Use of half ethylene glycol-half water as a coolant.

The "trickle" status entailed operation of the generator with little or no production of hydrogen, keeping temperatures above danger; use of alcohol and water as a coolant entailed blocking off the cooling system liquids from process liquids. Both procedures were satisfactory, giving protection down to about -10°F. Their effectiveness down to -25°F, was not tested, as testing was not worth the risk involved. In other words, generators were completely shut down and all coils drained when temperatures became dangerously low. It is worthy of note also that trickle status could not be maintained much below 0°F, due to low viscosity of fuel oil at that temperature. (TS)

C. One other result of the Moby Dick Hi operation at

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Francis E. Warren Air Force Base, Wyoming, was preparation of spare parts lists for each item of gas equipment. Generally speaking the spare parts kits prepared from the lists were adequate. The unforeseen breakage of equipment, notably cooling coils broken due to extreme cold, was not adequately covered by on-hand spares, therefore equipment was out of commission lacking parts. Furthermore, a firm statement of total adequacy of "number of items" in the spare kits can not be made for the reason that the kits were planned on the basis of 6 months consumption, whereas the operation was approximately of one month's duration. (C)

D. A photograph contained in the inclosure to this tab depicts the hydrogen generator arrangement similar to that employed by all launch sites. (U)

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Hydrogen Generators



Hydrogen Trailers

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TAB F

TRACKING

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I. TRACKING

A. Prior to Moby Dick Far East:

1. D/F Site Selection:

a. Locations of the HF/DF sites were selected by USAFSS to provide widespread DF coverage of balloons emerging from the area of interest. Criteria for selection of sites included: (C)

- (1) Climatology data affecting balloon penetration into friendly recoverable areas.
- (2) Availability of friendly areas for siting stations and ability to provide logistical support.
- (3) Dispersal of sites to minimize parallel bearings.
- (4) Dispersal of sites to provide an adequate quantity of cuts.
- (5) Dispersal of sites to provide back-up plotting for balloons in the Central Pacific Ocean area.
- (6) Consideration of balloon transmitter signal strength characteristics.

b. Ten locations selected were: Detachment 1, Shiroi; Detachment 2, Guam; Detachment 3, Wake; Detachment 4, Clark; Detachment 5, Yontan; Detachment 6, K-6, Korea; Detachment 7, Chitose; Detachment 8, Midway; Detachment 9, Shemya; Detachment 10, Elmendorf. The Shiroi detachment was to retain mobility for deployment to any area in which operational results indicated insufficient coverage. Allocation of AN/TRD-4, HF/DF sets to these ten locations was based on requirements for two sets at the locations serving as back-up in the Central Pacific Ocean area and three sets for those six locations nearest to the area of expected penetration. Two sets were planned for the mobile detachment. (C)

2. Description of AN/TRD-4:

This is a completely transportable radio direction finding station covering the frequency range of 540 kc to 30,000 kc, housed in an S-44/G shelter and equipped with two antenna systems: (a) a fixed position crossed loop antenna for ground wave and (b) a four element Adcock antenna for sky waves. The Adcock antenna, the system which we are concerned with, consists of four vertical monopole antenna erected in a square array centered over a 75-foot square wire mesh counterpoise. For the frequency range of 540 kc

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to 10,000 kc each of the monopoles consists of 4 AS-533/GR antenna sections with loading disk MX-1168/GR mounted on top to improve sensitivity, whereas for frequency range 3,000 kc to 30,000 kc only three sections of AS-533/GR without top loading disks are utilized. Approximately 36 man-hours are required for installation and calibration of either antenna system. (U)

3. Antenna Suitability for 119L Frequencies:

Planning by United States Air Force for HF frequencies to use during project 119L provided for 9 primary plus 9 secondary frequencies in a range from 4070 kc to 15,520 kc. The frequency range of either of the two DF Adcock antenna configurations is not compatible with the entire range of the assigned frequencies. Splitting antenna types at each DF location could possibly cause saturation of the set using the low range antenna, whereas that set with the high range antenna would have relatively little traffic. It appeared desirable to have all DF sets at each site capable of covering the frequencies to be used. The 6926th Radio Squadron Mobile was requested to perform tests during Moby Dick Far East in order to determine: (S)

a. AN/TRD-4 efficiency using the high range antenna with frequencies as low as 4,000 kc. (U)

b. AN/TRD-4 efficiency using the low range antenna with frequencies as high as 13,000 kc. (U)

Conclusion of tests revealed that the AN/TRD-4 with the low range antenna provides good results as high as 13,000 kc, whereas the high range antenna was not reliable on frequencies below 8,000 kc. Since the low range antenna could cover more of the desirable frequencies it was used during this project. (U)

4. 119L Balloon Frequencies: United States Air Force procurement of HF transmitters and associated components was based on the concept of balloons being launched from sites relatively close together causing those balloons launched at approximately the same time to travel in clusters (see paragraph 8, below). Balloon clusters could be tracked during the day on the higher frequencies and during the night on the lower frequencies. It was planned that the majority of balloons would be transmitting on the middle frequencies. This could cause the signals on the middle frequencies to interfere with each other preventing the direction finder operator from obtaining a bearing. It was determined that an equal number of HF transmitters must be launched on each frequency. No reports of interference from this source were received. (C)

5. Balloon Monitoring: The AN/TRD-4 was not designed to provide the capability of continuous, simultaneous monitor of all HF frequencies. To provide the capability of each DF tracking site

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to continuously monitor at least 9 HF frequencies, monitor facilities were established at all locations utilizing standard United States Air Force receiving equipment multicoupled to one AB-105A/FRC vertical antenna. The receivers are all installed in one location at each direction finding site with 5 radio operators each capable of monitoring two frequencies continuously. (U)

6. Communication Between D/F Sites and Evaluation Center: United States Air Force Security Service decided that individual direct CW circuits would be the most rapid means of passing bearing data from the DF sites to the Evaluation Center. For security reasons, a one-time pad encryption system was devised. (C)

7. DF Site Operation: When an operator in the monitoring facility hears a balloon transmission he immediately notifies one of the 2 or 3 DF facilities of balloon frequency and call sign. The DF operator tunes his receiver to the frequency and simultaneously indicates by a light switch to all monitoring positions that he is occupied. As other balloon transmissions are received by the monitors, the above process is repeated. The DF operator, after taking a bearing, applies a classification testifying as to the quality (good, fair, unreliable) of the bearing and passes his bearing to the supervisor/controller for encryption and further transmission to the evaluation center. All communications between the monitor operator, DF operator and supervisor/controller is via intercomm. Site bearing error (predetermined by the evaluation center through periodic calibration checks) is applied to the bearings by the evaluation center. All operating procedures pertaining to the entire tracking and communication systems are contained in a special Manual of Operations prepared and published by the 6926th Radio Squadron Mobile. (C)

B. Moby Dick Far East:

This project was developed primarily to provide intensive and realistic direction finding training and to obtain factual information on the capabilities and limitations of the 6926th Radio Squadron Mobile. Prior to this project squadron personnel had received a very limited amount of direction finding training and had not operated as a unit. During Moby Dick Hi 60 airmen operators received direction finding training while on TDY status to various AACS operated DF sites and another 20 airmen and 4 officers activated and operated a plotting and evaluation center. These personnel represented 11 per cent of the total personnel requirements and during the Moby Dick Hi project, prior to 6926th Radio Squadron Mobile deployment, were able to obtain experience on only 24 balloon flights. Thus, barely indoctrinated in balloon tracking and plotting, they were to serve as the nuclei in training others during Moby Dick Far East. (C)

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1. Training Period: The period between 1 July and 7 September 1955, was spent in deployment of personnel and equipment, installation of facilities and classroom type training at all locations. Inasmuch as United States Air Force Security Service had prepared detailed site installation specifications, and communications support for allocations had been clearly defined, no difficulties were anticipated or encountered in this area. A complete and very detailed indoctrination and training manual had been prepared by 6926th Radio Squadron Mobile, and classroom training using this manual as guidance, plus the experience gained during Moby Dick Hi, provided the background which permitted the 6926th Radio Squadron Mobile to commence Moby Dick Far East training in the fundamentals and needing only actual balloon tracking experience to reach an effective stage. During the period 7 September 1955 to 1 January 1956, 211 balloon flights were flown to provide the actual experience required. Progression was rapid and the 6926th Radio Squadron Mobile was declared operational on 15 November 1955, by the Commander, 456th Troop Carrier Wing. (S)

2. Balloon HF Frequency Testing: An additional use made of this project was the testing of balloon HF frequencies to determine range characteristics and interference. All primary HF frequencies were flown with results being good. Generally, fixes were obtainable at maximum distances between 1000 to 2200 miles. Interference was negligible on all frequencies used. (C)

C. Primary Mission:

1. Ground Cut Down Stations: Prior to beginning the primary mission, a decision was made by this headquarters not to allow balloons to pass over Japan into the Pacific Ocean area. This headquarters charged the 456th Troop Carrier Wing with developing 4U system cut down equipment as a fixed ground installation for use during periods of restricted air activity, i.e., during hours of darkness and instrument weather. The 456th Troop Carrier Wing engineered and developed a facility similar in design to the SCR-575 VHF/DF facility developed in World War II. For additional range, a Yagi antenna was designed, tested and found satisfactory. The entire facility was flight tested at Charleston, S.C., proved adequate, and subsequently was installed at each recovery base (except Johnson) and at the the Recovery Control Center, Shiroy. Complete, unbroken VHF coverage was afforded at balloon altitude from Northern Formosa to the northern tip of Hokkaido. (See coverage charts contained as inclosures 3 and 4, Tab G, this chapter). One additional installation was later activated at Niigata, Japan, to provide additional cover between Shiroy and Misawa. The effectiveness of these facilities was realized when during the course of operation 14 balloon flights were terminated which may have complicated recovery by progressing out of range over the Pacific Ocean or which may otherwise have been lost. (S)

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2. Balloon HF Frequencies: Of the 9 primary and 9 secondary frequencies authorized, this headquarters decided to use only the 15 lowest frequencies. Factors affecting this decision were: (a) Success of AN/TRD-4 tests with the low range antenna for frequencies as high as 13,000 kc, (b) frequency evaluation report received from National Security Agency (NSA) advising that these frequencies would be effective, (c) availability of transmitter components at launch sites, and (d) minimize saturation in the recovery area. Nine different frequencies, in equal quantities, were used for the first 20 days of operation. Two of these were discontinued for operational reasons and a new and tenth frequency implemented. A new frequency plan was made up and became effective on 19 February 1956, utilizing 4 new frequencies and 4 of the original starting frequencies. Frequencies were subsequently to be changed periodically commensurate with monitoring capabilities of the 6926th Radio Squadron Mobile. The new frequency plan was not implemented due to termination of the project on 1 March 1956. (S)

3. Time-on of HF Transmitters:

a. Extensive research and planning were required in order to determine the appropriate odometer settings for the balloon radio activation times. Two essentially contradictory criteria had to be considered: (S)

- (1) Balloons should not transmit while traversing unfriendly territory inasmuch as the Soviets, with their effective direction finding system, were considered capable of monitoring and tracking balloon signals. (TS)
- (2) Due to the high speed winds which occur over the Japanese area, it was considered mandatory to insure that our tracking would commence a few hours before the balloons entered this primary recovery area. Aircraft could then be alerted in time to intercept each flight before it over-flew the Japanese Islands. (S)

b. The latter of the above criteria was considered to be the determining factor for the radio activation times. Accordingly, the premise adopted was that balloons should transmit as late as possible but at the same time, as early as required to insure that all balloons would be heard before entering the recovery area. Using climatological wind data and hypothetical balloon tracks from each of the launch sites, minimum elapsed travel times from launch to the recovery area were computed. Based on these figures, the following HF transmitter turn-on times were specified for the initial period of operation:

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- (1) Oberpfaffenhofen - 80 Hours
- (2) Adana - 50 Hours
- (3) Gardermoen - 84 Hours
- (4) Evanton - 90 Hours
- (5) Giebelstadt - 80 Hours

(TS)

c. Positions of balloons at the times shown above along with trajectories which might bring them into the recovery area in seven days or less were computed. The envelopes containing these positions were drawn for each launch site and are shown as solid lines on inclosures 1 through 5. The size and shape of these envelopes are indicative of the variability in the wind direction and speeds expected. All actual first transmissions of project balloons were plotted on these same inclosures for comparative purposes. The balloon flight number (from the appropriate site) is indicated for each such plot. (S)

d. Subsequently, after several weeks of operation, it was believed that excessive losses were being suffered due to unfriendly activities against project vehicles due, in part, to their being tracked through their HF transmissions. Consequently, twelve hours was added to the radio turn-on times for all sites on 31 January 1956, excepting Adana, in an effort to reduce the balloon vulnerability. (TS)

4. Adequacy of DF Site Locations:

a. Early operational results revealed two areas in which DF coverage could be bolstered. As was previously believed, the 2 Alaskan DF sites (Shemya and Elmendorf) provided insufficient coverage for the Bering Sea and Northwestern Alaskan areas. Final plans were completed and one AN/TRD-4 set, removed from the Guam detachment, was airlifted to Nome, Alaska. This DF site became operational on 18 February 1956, with the following capability: (C)

- (1) One AN/TRD-4.
- (2) Capable to perform continuous monitor on 4 balloon frequencies at the direction of the Shiroi Recovery Control Center. (S)
- (3) Pass bearings over a direct teletype circuit to the Elmendorf detachment for relay to the Evaluation Center. (C)

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b. The Clark DF site was reported by the Commander, 456th Troop Carrier Wing, to be somewhat ineffective in providing Northerly cuts on balloons traveling Eastward in the vicinity of 35 to 40 degrees North latitude and West of 110 degrees East longitude. Approval was received from Far East Air Forces to conduct a site survey on Formosa for activation of a DF facility. Survey was conducted, however site was not used due to termination.(S)

c. See "D/F Range", inclosure 6, for areas of reliable DF coverage. (U)

5. HF/DF in European Theater: The Commander, Detachment 1, 1st Air Division, established procedures with National Security Agencies in Europe to perform continuous monitor of HF balloon frequencies being used for launches. Actual monitoring was delegated to units of the 6950th Security Group. In the event balloon signals were heard, the 6950th Security Group was authorized by National Security Agency to call on British, U. S. Naval and Canadian stations to assist in obtaining fixes. Fixes received were to be passed to Detachment 1, 1st Air Division by the 6950th Security Group for plotting and coordinating recovery action as necessary. (S)

6. Total Bearings: The following is a total recapitulation of all bearings used for fix plotting for the entire primary mission:

DETACHMENT	CLASS A	CLASS B	CLASS C	CLASS D	TOTAL
1 - Shiroy	680	1266	757	78	2781
2 - Guam	89	367	690	543	1689
3 - Wake	219	563	1175	367	2324
4 - Clark	106	486	994	392	1978
5 - Yontan	318	1229	1078	245	2870
6 - K-6	1567	978	576	454	3575
7 - Chitose	202	1055	1272	660	3189
8 - Midway	576	577	295	183	1631
9 - Shemya	477	908	655	346	2386
10- Elmendorf	31	106	185	122	444
Total	4265	7535	7677	3390	22867

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7. Accuracy of Fixes:

a. The method used to determine the accuracy of the HF/DF fixes was to compare the fixes with the photographic plots. These plots were available for daytime comparison only. Due to the propagation characteristics of the HF Frequencies used, the daytime ranges were somewhat reduced. It was determined that fixes provided on vehicles in the recovery area during the daytime were generally within 50 miles of the photographic plot and this was considered adequate to meet the requirements. Little success was obtained in providing other than estimates of location on balloons near and West of 110 degrees East longitude. (S)

b. The 6926th Radio Squadron Mobile based fix classification on the following standards: (C)

- (1) Class A - 90 percent probability that the true position of balloon is within 25 miles of fix point. (C)
- (2) Class B - 90 percent probability that the true position of balloon is within 50 miles of fix point. (C)
- (3) Class C - 90 percent probability that the true position of balloon is within 100 miles of fix point. (C)
- (4) Class D - 90 percent probability that the true position of balloon is within 200 miles of fix point. (C)

c. Listed below is a summary of the accuracy of D/F fixes, utilizing a total of 64 fixes from 16 balloon flights for which fixes and photographic plots were correspondingly available. All data is for daytime only and does not take into consideration frequency propagation characteristics nor the locations of D/F detachments providing the bearings used. In this summary the area of D/F coverage was further divided into three areas as follows: (C)

- (1) Area 1. Fixes West of 110° East Longitude. (S)
- (2) Area 2. Fixes between 110° and 125° East Longitude. (S)
- (3) Area 3. Fixes East of 125° East Longitude. (S)

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Area 1	A	B	C	D
Number of Fixes	-	1	5	2
Average Error (Nautical Miles)	-	45	87	124
Area 2	A	B	C	D
Number of Fixes	1	3	10	9
Average Error (Nautical Miles)	22	115	138	149
Area 3	A	B	C	D
Number of Fixes	11	19	3	-
Average Error (Nautical Miles)	43	42	37	-

(U)

d. All efforts were made to provide the Recovery Control Center with fixes on each balloon transmission received. In Areas 1 and 2 conditions frequently occurred when many balloon transmissions resulted in only one or two bearings being obtained which could only be evaluated into balloon estimates of locations. These conditions were not constant and varied with the time of day and frequency propagation characteristics. In addition to the fixes tabulated above, the analysis of the same balloon flights reveal that the average error of estimates of location was 357 miles for Area 1 and 250 miles for Area 2. (C)

8. Programmed procurement of HF transmitters and conversion kits. Divide by 5 for launch detachment totals. (S)

FREQUENCY (KC)	PRIMARY OR SECONDARY	AMOUNT OF TRANSMITTERS	AMOUNT OF CONVERSION KITS
4070	Primary	180	
4385	Secondary		180
4400	Primary	225	
4415	Secondary		240
4675.5	Primary	355	
4695	Secondary		360
5566	Secondary		440
5627.5	Primary	461	
8945	Primary	508	
10030	Secondary		540

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FREQUENCY (KC)	PRIMARY OR SECONDARY	AMOUNT OF TRANSMITTERS	AMOUNT OF CONVERSION KITS	
10040	Primary	164		
10075	Secondary		480	
11385	Secondary		300	
12851	Primary	280		
13010	Primary	220		
13320	Secondary		240	
16502.5	Primary	160		
16520	Secondary		180	(U)

9. Inclosures:

a. Attached as Inclosures 1 through 5 are charts indicating the outline area in which the HF transmitters were forecast to commence operation from each launch site. This area takes into consideration the shortest and longest elapsed travel time. The points and associated numbers indicate those balloon flights on which initial fixes were established. (C)

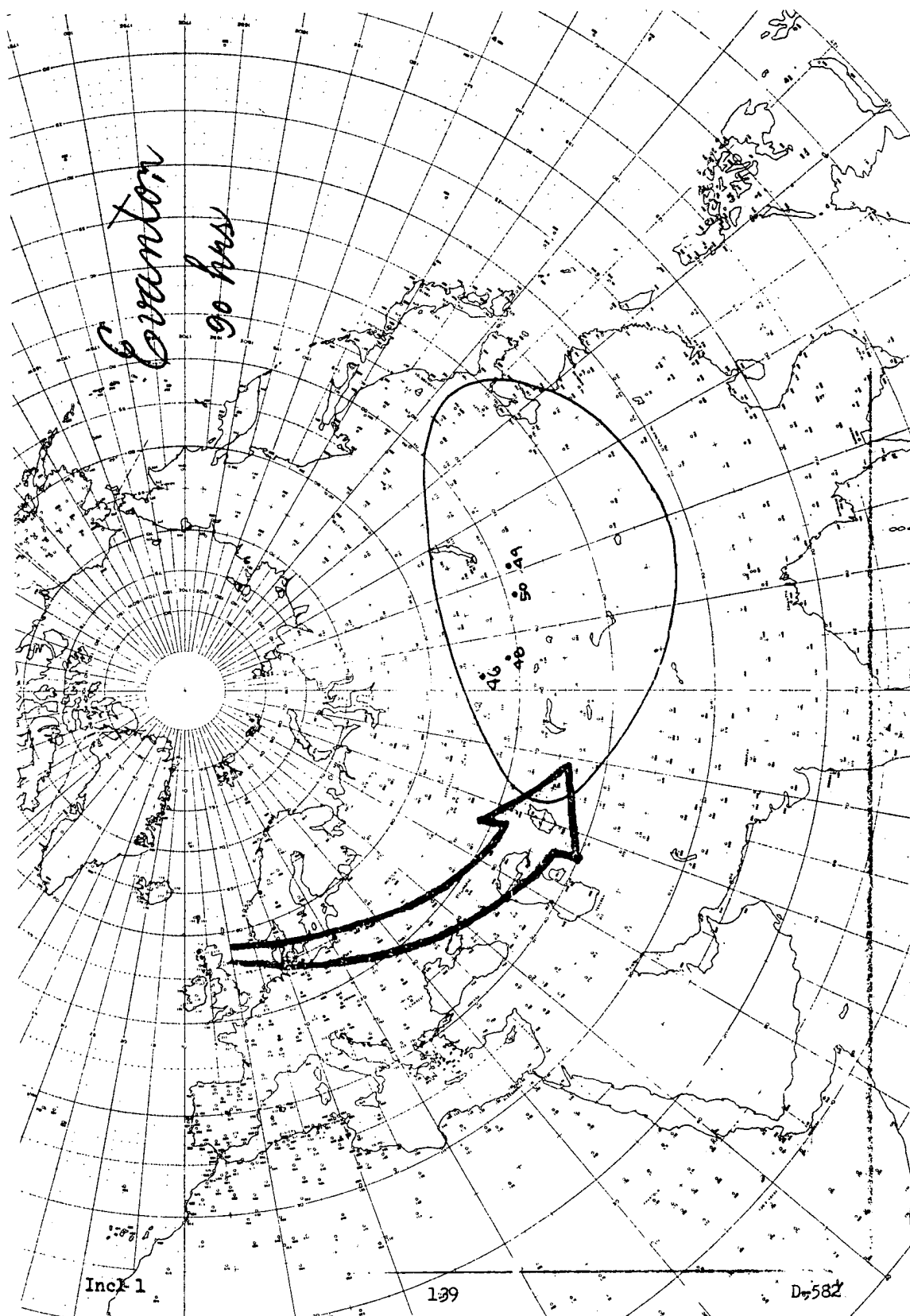
b. Attached as Inclosure 6 is a chart indicating the reliable and possible coverage that could be expected from the various HF/DF sites under normal conditions. (C)

c. Attached as Inclosures 7 through 11 are charts indicating the trajectories plotted from HF/DF fixes on the balloon flight originating from each launch site. (C)

d. Attached as Inclosure 12 are photographs of a standard tracking site. (C)

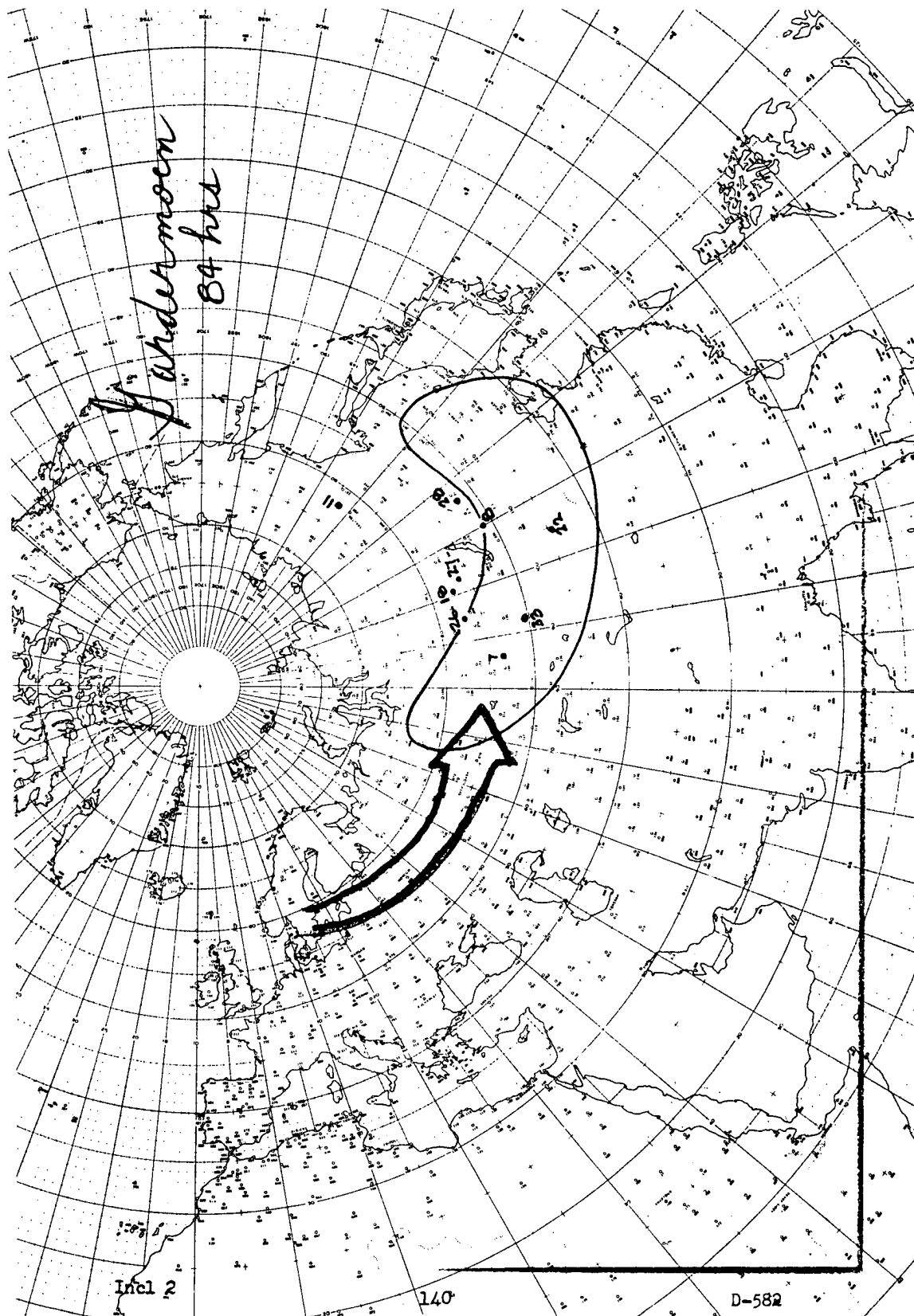
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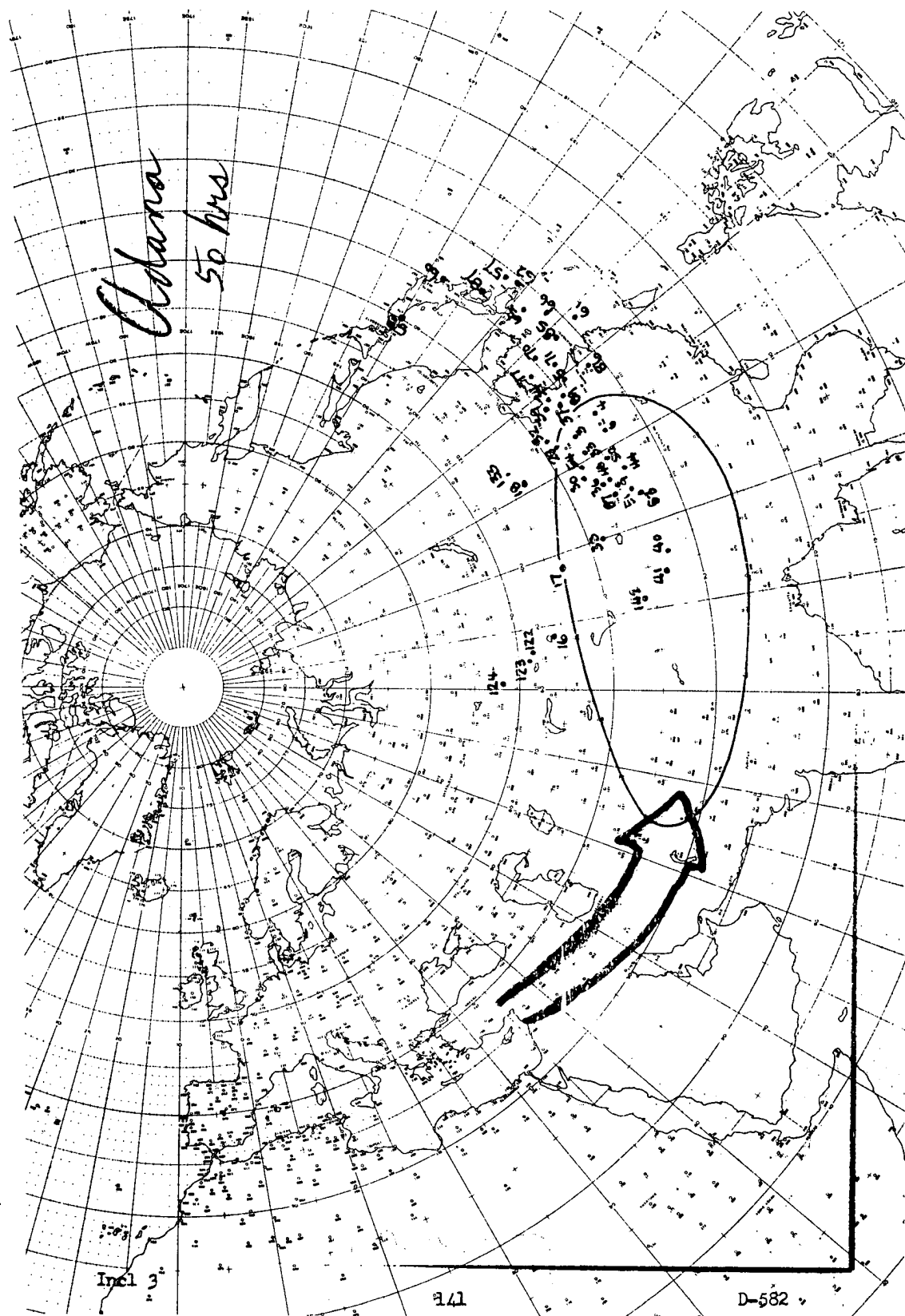
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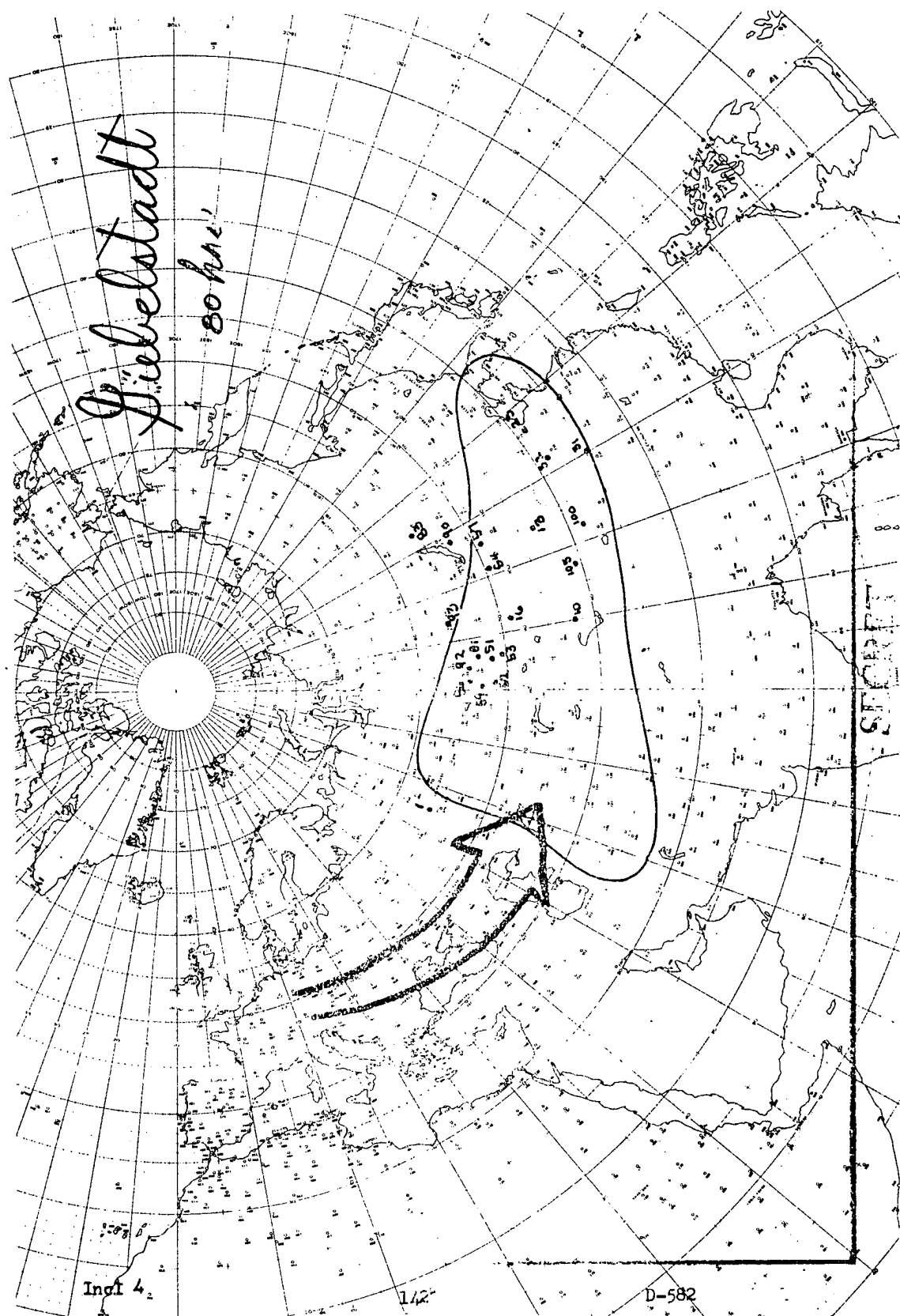
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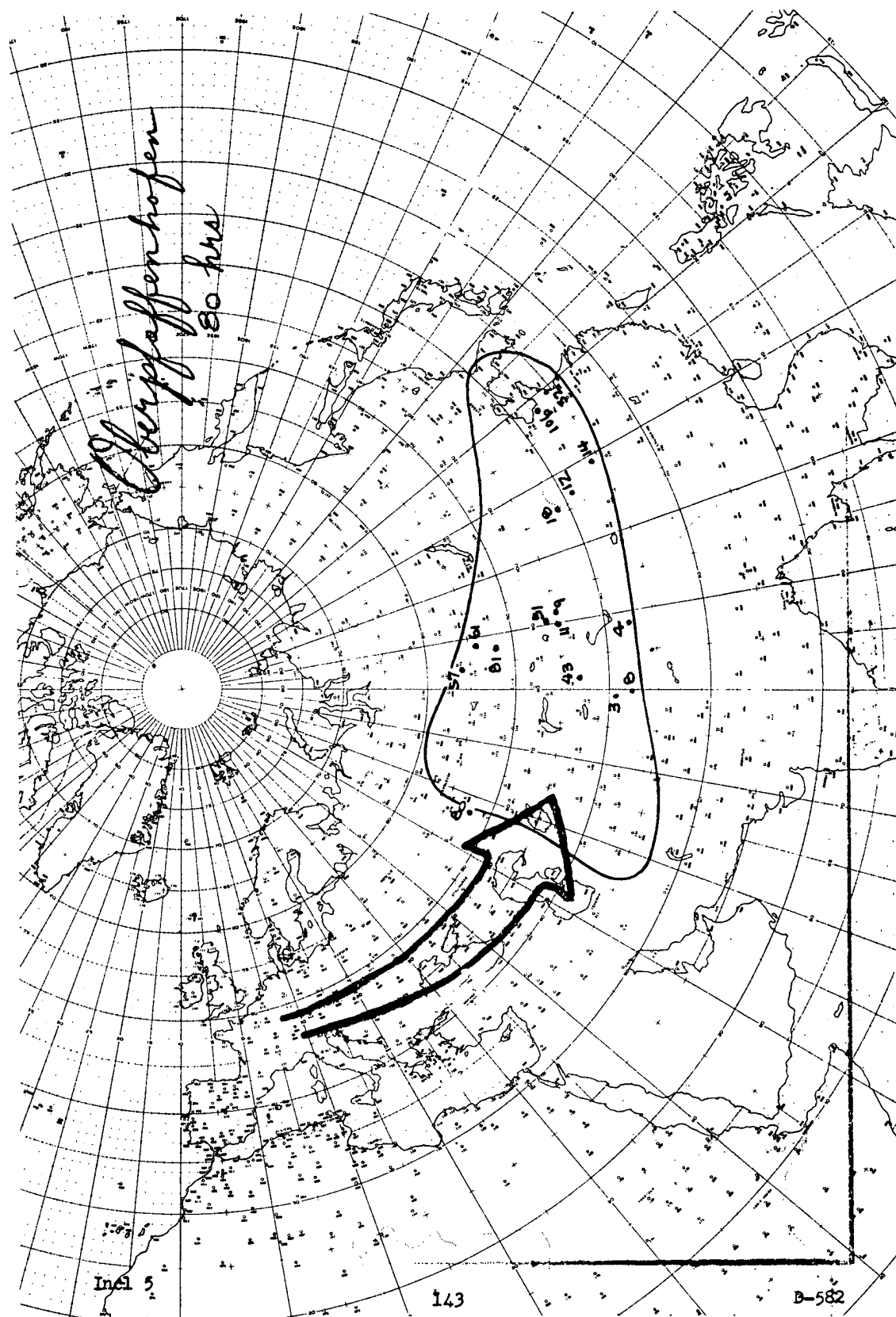
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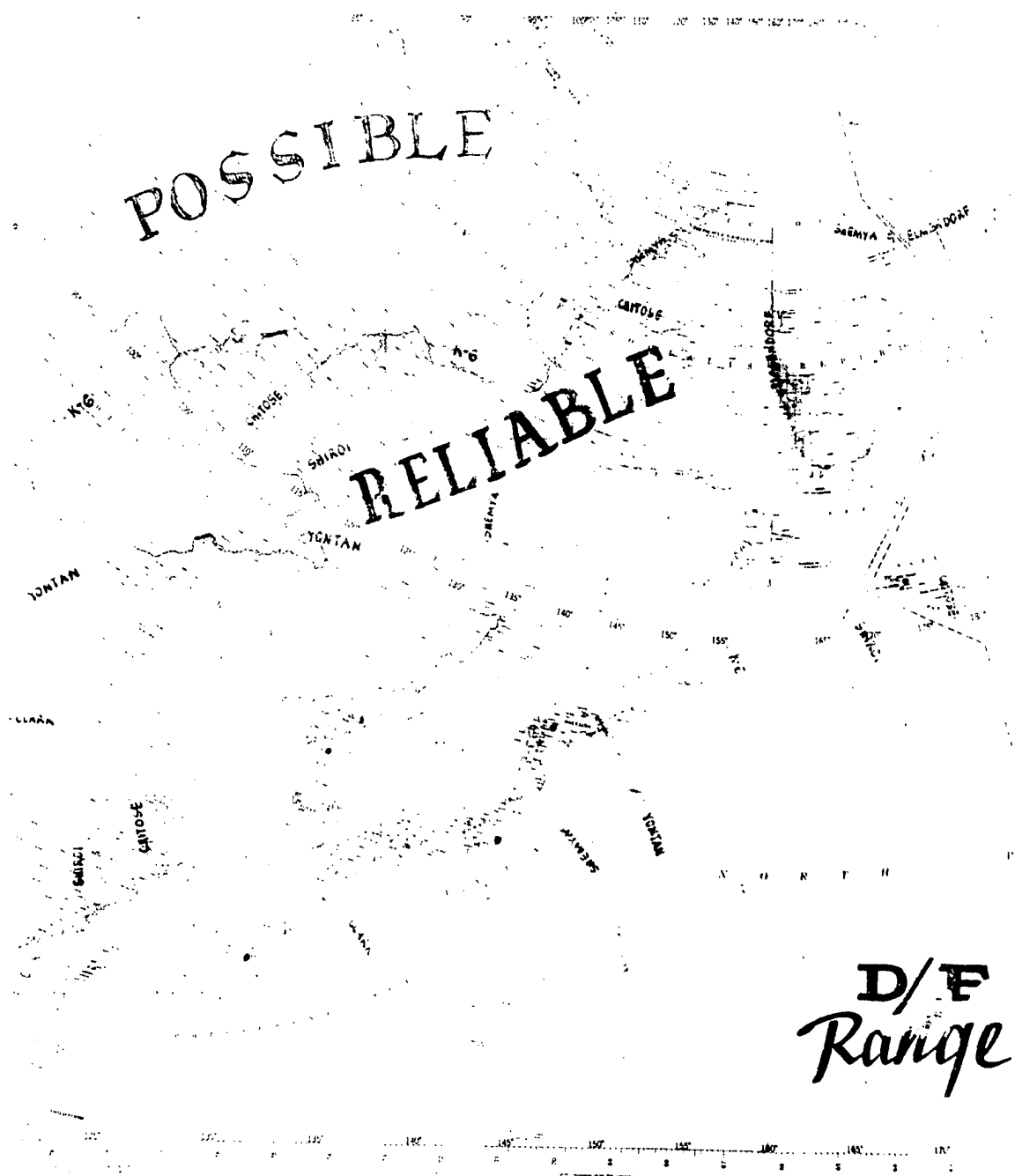
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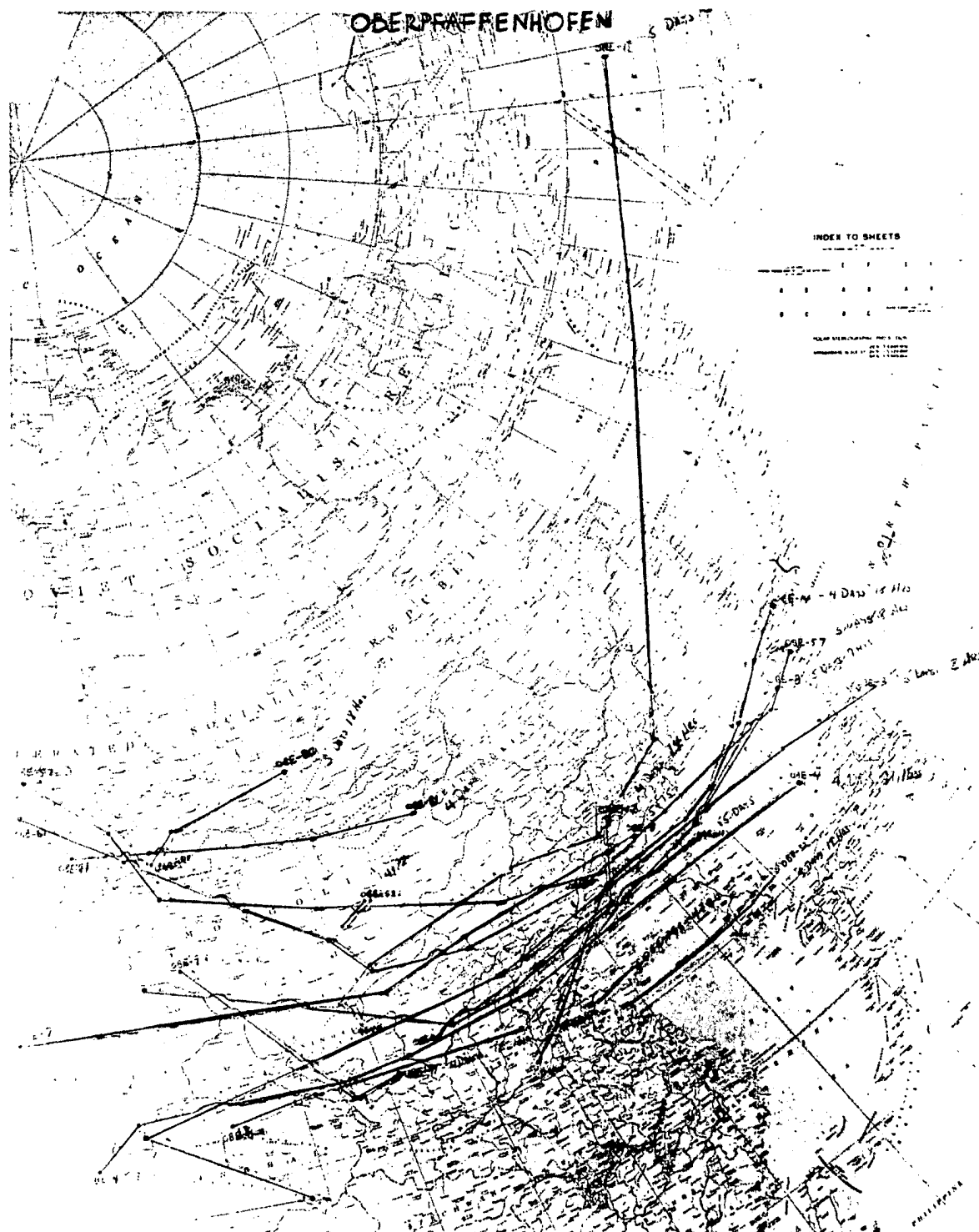
Incl 6

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Incl 7

OBERPFAFFENHOFEN BALLOON TRACKS

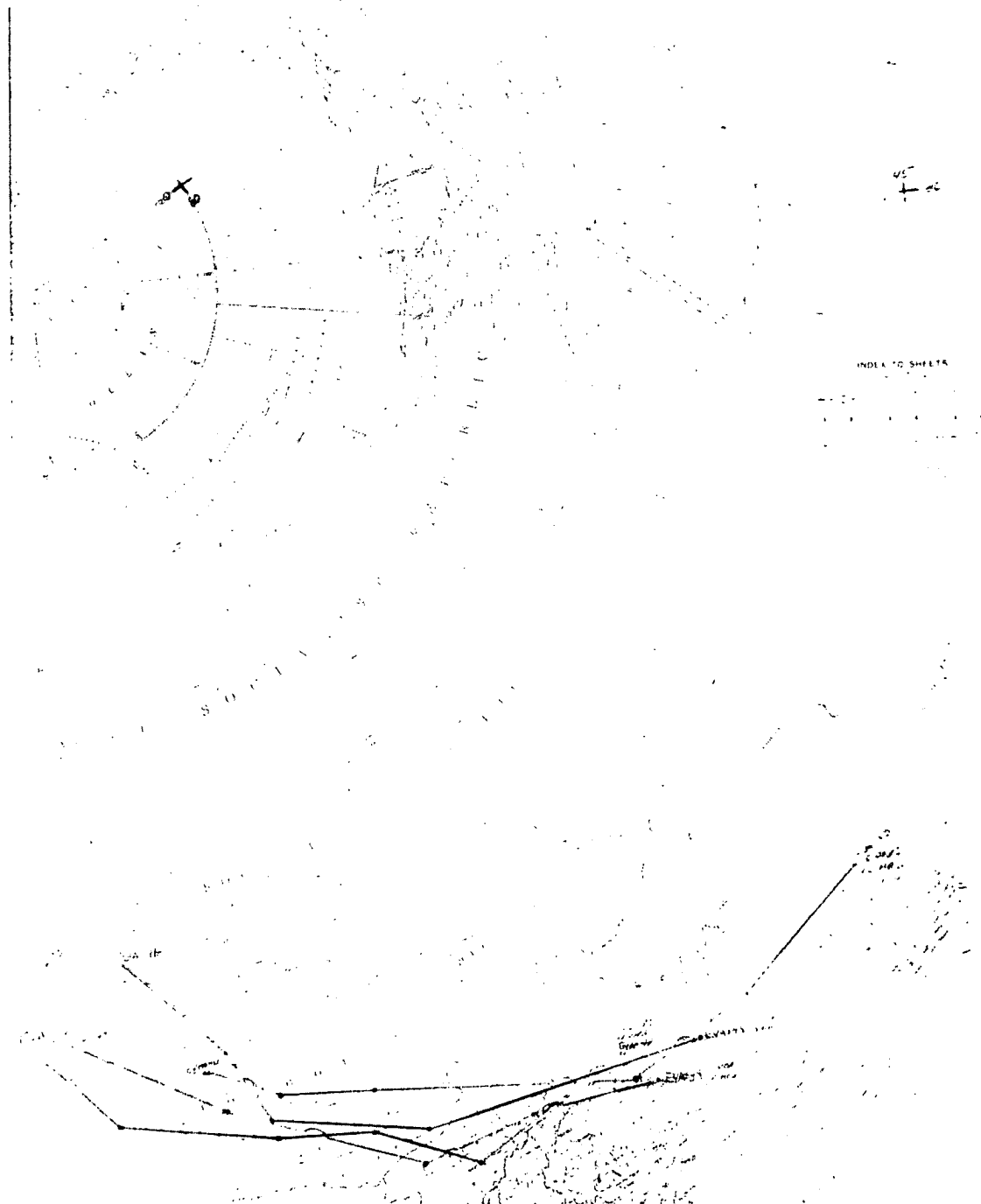
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EVANTON



Incl 8

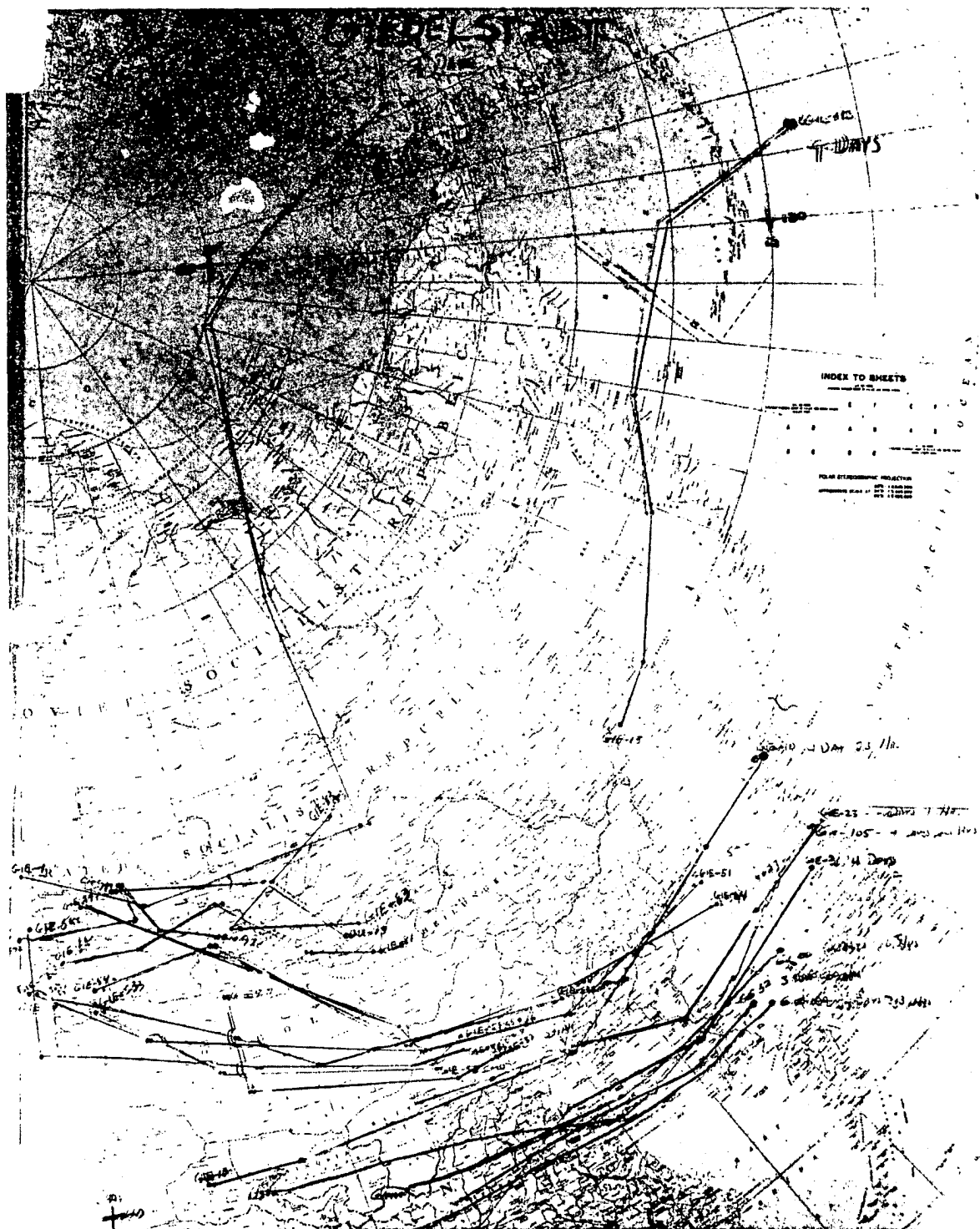
EVANTON BALLOON TRACKS

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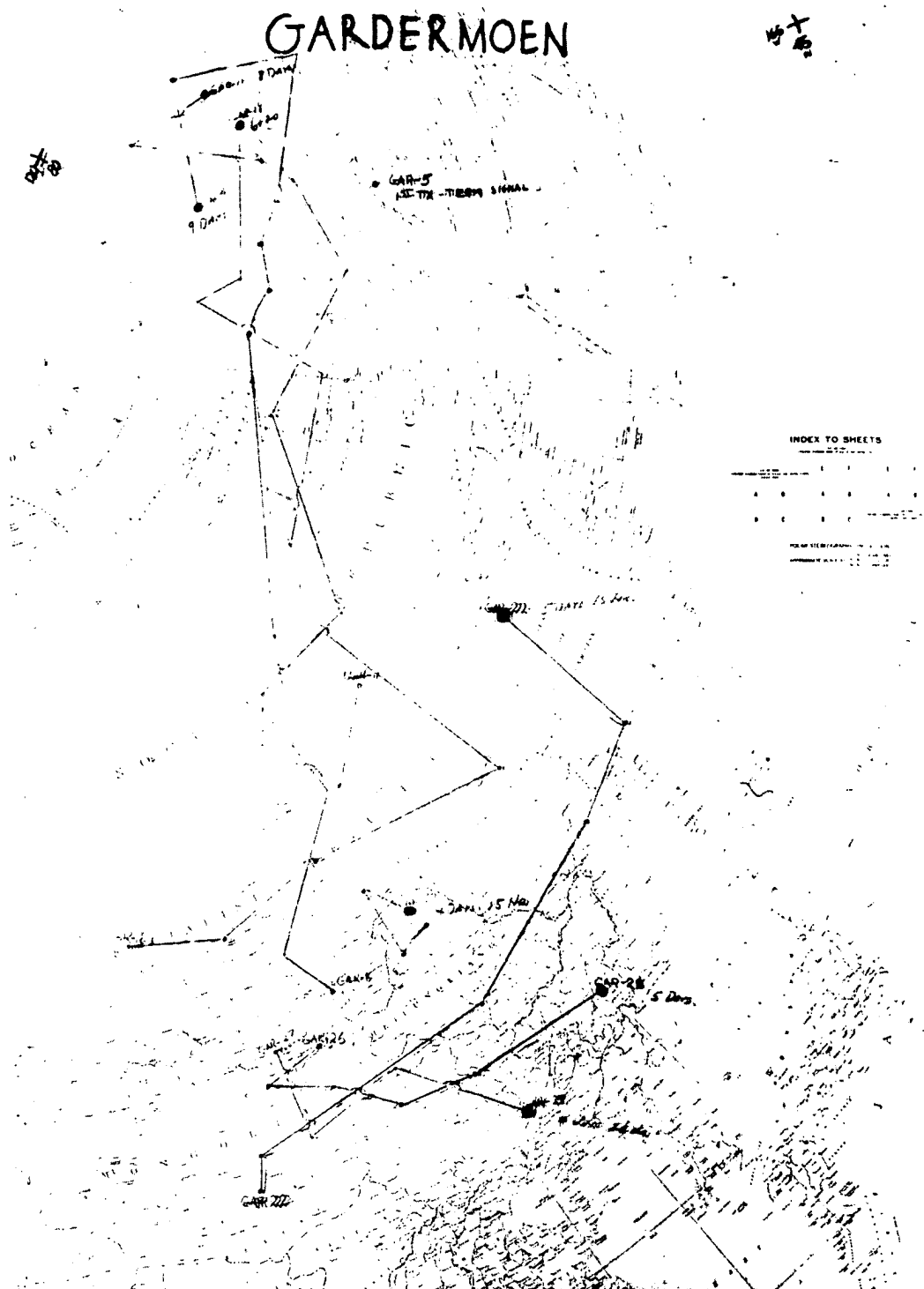
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GIEBELSTADT BALLOON TRACKS
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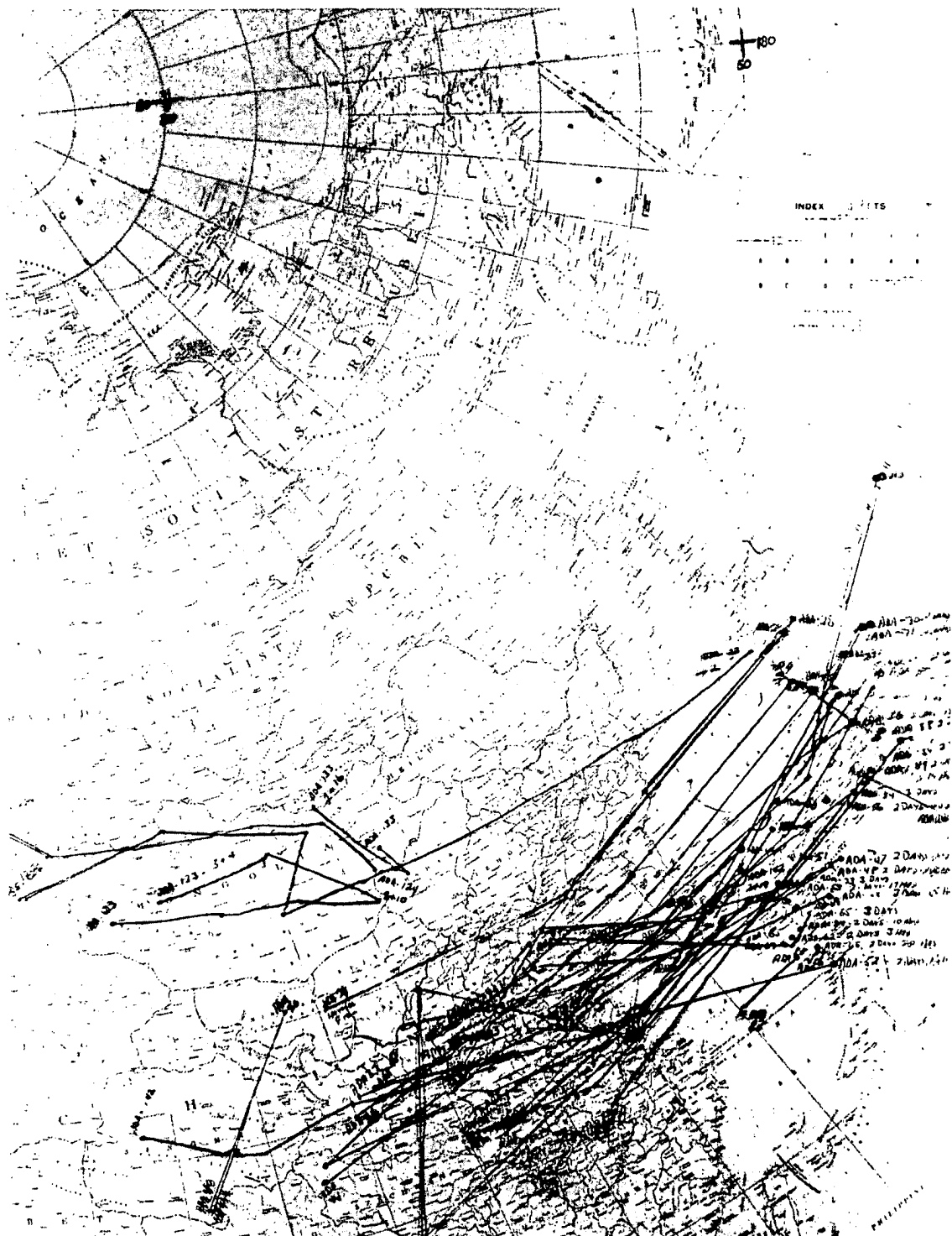
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Incl 11

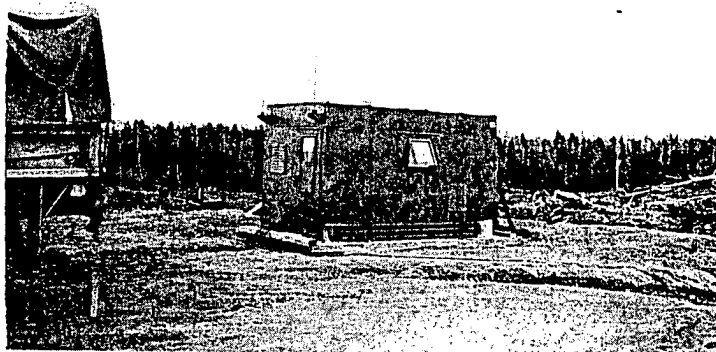
ADANA BALLOON TRACKS

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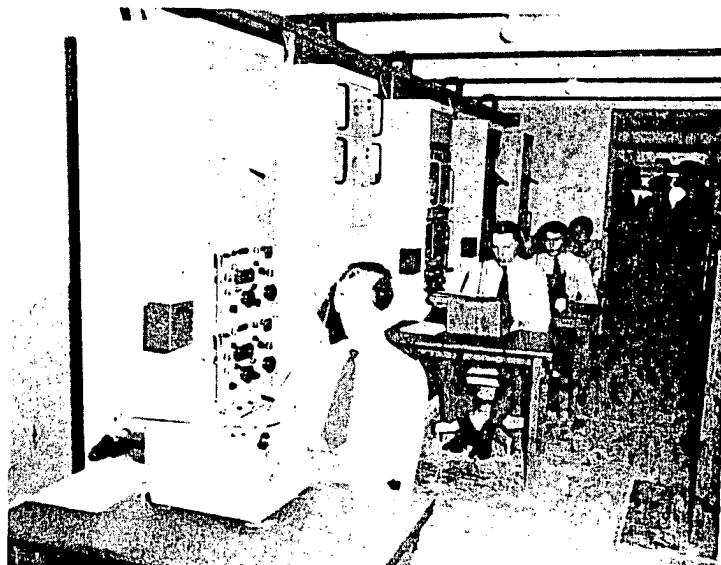
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Tracking Station, AN/TRD-4
Adcock antenna not shown



Monitoring 119L Transmission

Incl 12

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TAB G

RECOVERY

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I. RECOVERY OPERATIONS

A. A Recovery Control Center, RCC, was established by the 456th Troop Carrier Wing at Shiroy Air Base, Japan, to direct, monitor and control all recovery operations. Balloon fixes were passed to the Evaluation Center by the Tracking Control Center, TCC. The Evaluation Center plotted lines of position, and passed fixes to the RCC. The RCC maintained current position, track and forecast trajectory of each balloon. The RCC staff, based on all known information, directed the dispatch of recovery aircraft and crews for intercept of balloons. (S)

B. Recovery Detachments, consisting of eight (8) C-119 aircraft, crews and support personnel were stationed as follows: (C)

1. 744th Troop Carrier Squadron, Kadena Air Base, Okinawa.
2. 745th Troop Carrier Squadron, Adak Naval Air Station, Alaska.
3. 746th Troop Carrier Squadron, Kodiak Naval Air Station, Alaska.
4. 744-1 Troop Carrier Squadron, Itazuke Air Base, Japan.
5. 745-1 Troop Carrier Squadron, Misawa Air Base, Japan.
6. 746-1 Troop Carrier Squadron, Johnson Air Base, Japan.

C. Each Recovery Detachment maintained a Recovery Control Center. Upon receipt of a mission directive from the Wing RCC the Detachment RCC would dispatch aircraft to intercept the target. Normally, two (2) C-119 aircraft were dispatched for each interception. Crews were maintained on 30 minute operational ready alert. (C)

D. The following working positions were established within the RCC (Inclosure 1, this Tab): (S)

1. Commander 456th Troop Carrier Wing.
2. Deputy Commander 456th Troop Carrier Wing.
3. Staff Operations Officer.
4. Chief Controller

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5. Weather Officer.
6. Navigation Officer.
7. D/F Officer.
8. Mission Assignments Officer.
9. Combat Readiness Officer.
10. Reports Control Officer.
11. Alaskan Liaison Officer.
12. Launch Monitor Officer.

E. The period during Moby Dick Far East was used to finalize detailed operating procedures to be used during the primary mission for notifying and monitoring the activities of supporting recovery forces (Air Rescue Service; United States Army; United States Navy; United States Coast Guard; Japanese Maritime Fleet and Civil Police). The 3d Air Rescue Group at Nagoya, Japan, was designated the executive agent for Far East Air Forces in coordinating the efforts of all agencies, except for 456th Troop Carrier Wing, participating in the recovery of downed packages. The 2d Air Rescue Group at Clark Air Force Base, in conjunction with the 3d Air Rescue Group at Nagoya, functioned as the executive agent for coordinating the efforts of agencies within the 2d Air Rescue Group area of search and rescue responsibility. To obtain assistance from supporting recovery forces, the RCC forwarded the position of downed packages to the 3d Air Rescue Group, who in turn relayed the information to the appropriate agencies for recovery action. (S)

F. Aircraft: The C-119F aircraft modified as indicated below was the primary vehicle used for recovery. (C)

1. Flight Operable Doors: The standard clam shell cargo doors were removed and doors which could be opened and closed in flight were installed. The doors were hydraulically actuated and when opened in flight result in minimum drag. (U)
2. Auxiliary Fuel Tanks: A 1000 gallon auxiliary fuel tank was installed in the cargo compartment. This increased the operating radius to approximately 1000 nautical miles. (C)
3. Radar Altimeter (APN-22): The radar altimeter was installed to give absolute altitude readings. This is an absolute requirement during air-to-water recovery operation. (C)

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4. Dual Generators: The dual generator modification was made on aircraft which were to operate in the Arctic area. This was necessary since de-icing equipment on the aircraft is electrically operated and should one generator fail there would not have been sufficient power remaining to properly operate the recovery equipment. (C)

5. UHF Homer (ARA-25): The ARA-25 was installed to provide plane-to-plane homing while on recovery missions and also a D/F capability for recovery aircraft in event of an emergency. The ARA-25 also provided capability of homing in on locator beacon. (C)

6. Oxygen: Six additional crew member stations were added. This was necessary to accommodate crew members whose duty station is in the cargo compartment of the aircraft. (U)

7. Model 80-C Pickup Unit: This unit was installed in the aircraft. For detailed description of the unit see "Handbook of Operation - Model 80-C Unit Installed in C-119 Aircraft". (C)

G. Standing Operating Procedures developed prior to commencing operations were found to be generally adequate. Some changes were necessary when it was determined that neither the water station nor the locator beacon functioned properly. Some packages were lost as a result of these failures. To prohibit losses under these conditions, this headquarters directed that all balloon flights be terminated in the water West of the Japanese Islands or over the Japanese Islands. (S)

H. A geographical operating limit ranging from 10 up to 140 miles from Communist dominated territory was established beyond which recovery aircraft were not permitted to fly. (See photo contained in Inclosure 2 this Tab) By establishing this limitation, recovery aircraft could accomplish assigned mission without interference with other operations and avoid incidents which might prove embarrassing to the United States. During Moby Dick Far East a recovery aircraft flying East of Hokkaido on a navigation training mission was intercepted by Soviet fighter aircraft. The recovery aircraft immediately turned South and no firing passes were made by the fighters. It was later determined that the recovery aircraft was approximately 100 miles North of course at point of interception. The Commander, 456th Troop Carrier Wing immediately directed that recovery aircraft would not fly within 100 nautical miles of the geographical limitation established until the primary mission commenced. No other such incidents occurred during the project. (TS)

I. Ground cut-down stations were established at Misawa Air

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Base, Shiroy Air Base, Itazuke Air Base, Kadena Air Force Base, Adak Naval Air Station, Niigata Air Base and Kodiak Naval Air Station. (See Inclosures 3 and 4 to this Tab) These stations provided a backup for recovery aircraft operation. This backup proved valuable on **several** occasions, one of which being when unforecasted high winds moved a large number of balloons into the recovery area during poor weather conditions. In those instances where recovery aircraft could not be employed, the ground stations, upon instructions from the RCC, terminated the balloon flight over land. (S)

J. Aircraft normally worked in pairs beginning recovery passes at 20,000 feet. (See chart of recovery patterns contained in Inclosure 5 this Tab) The flight commander acted as the primary aircraft and the wingman was the spare. One of the cluster of five parachutes, which lowered the balloon payload to the surface after cut-down, was a drogue chute. When deployed the drogue chute extended approximately 105 feet above the remaining four chutes. Extended from the rear of the recovery aircraft, at a 45 degree angle, were two 34 foot poles. These poles were used to hold the nylon cord loop, with grappling hooks attached, in position during attempted air-to-air contact. The recovery aircraft attempted to contact the drogue chute by flying directly over it, permitting the grappling hooks to engage the drogue chute. Continuous passes were made by the primary and spare aircraft until the air-to-air pickup was successful or the package descended to the surface. When the package landed in the water, an air-to-water recovery was attempted, if operationally feasible. (See Inclosure 6 to this Tab) Recovery equipment configuration remained the same for air-to-water pickup as that used for air-to-air; except that the nylon cord loop did not have grappling hooks attached. The recovery aircraft attempted to make the air-to-water recovery by flying directly over the downed package permitting the hook on the top of the water station to engage the nylon cord loop on the aircraft. No air-to-water recoveries were made due to failure of the water station. (S)

K. The first 119J system to arrive in the recovery area was recovered air-to-air by C-119 aircraft. Of the 67 balloon systems which transited the target area and arrived in the Far East recovery area, a total of 38 were electronically terminated by aircraft. 16 of these 38 were recovered by air-to-air method. Where air-to-air recovery was attempted, 3 systems were missed due to techniques of C-119 crews. Air-to-air recovery of the remaining systems was not accomplished due to darkness (15), equipment failure (1), drogue chute failure (3), termination by ground to air method (3), termination by fighter aircraft (1), and the fact that termination was not possible (10). (TS)

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L. A total of 44 systems have been recovered and shipped to the Zone of Interior for processing as of 2 March 56. The general locations of the 23 unrecovered systems, which are known to have entered the recovery area, are shown in Tab M, this Chapter. (S)

M. C-119 aircraft were employed for actual air-to-air recoveries during VFR weather conditions only. During periods of adverse weather conditions, C-119 aircraft were assigned patrol and tracking missions, and upon instructions from the RCC, electronically cut-down specified balloon systems. (S)

N. During period 9 May 1955 thru 25 February 1956 a total of 24,623 flying hours were utilized by the recovery aircraft. Of this total flying time, 29% was utilized during the primary mission period. (Section III, Tab T, Inclosure 5) Aircraft utilization rate during primary mission period was 1.9 hours per aircraft per day. The assigned aircraft incommission rate for the same period (9 May 1955 thru 25 February 1956) was 68%; however, during the primary mission period the incommission rate was 80%. (Section III, Tab T, Inclosure 6) (S)

O. R-3350-89 and 89A aircraft engines were used on C-119F aircraft assigned the 456th Troop Carrier Wing. Based on the computations of the number of engines removed for major overhaul, the number of hours since last major overhaul, and the engineering estimate of life expectancy for the 89 (600 hours) and 89A (700 hours), it was revealed that the unmodified engine (R-3350-89) was performing better than the modified engine (R-3350-89A). Only 21.9% of the 89's were removed with less than 200 hours since last major overhaul as compared to 78.6% for the 89A's. (Section III, Tab T, Inclosure 4) (C)

P. There were four C-119 aircraft accidents during the period of time the 456th Troop Carrier Wing was under the operational control of 1st Air Division. Only one of these accidents were directly attributable to the specialized requirements of the primary mission. (S)

1. At Charleston Air Force Base an engine failed on take-off and the C-119 aircraft crashed in an attempt to return to the field. (U)

2. At Kadena Air Force Base a B-29 aircraft taxied into a parked C-119 aircraft, causing major damage to the cockpit area of the C-119. (C)

3. At Misawa Air Base extensive damage was sustained by the landing gear of a C-119 aircraft. (C)

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4. At Charleston Air Force Base propeller damage was sustained when the propeller struck the drogue chute of the 119L system during a practice air-to-air recovery attempt. (C)

Q. Conclusions:

1. The C-119 aircraft:

a. Is useful to perform air-to-air electronic cut-down, however this could be accomplished by several other aircraft types. (TS)

b. Is too slow to overtake the balloon due to approximately equal groundspeeds of the balloon and aircraft under certain jet stream conditions. Success was assured only when the aircraft could assume a position ahead of the balloon. (C)

c. Air-to-air recovery capability was dependent upon the existence of daylight and VFR conditions. (S)

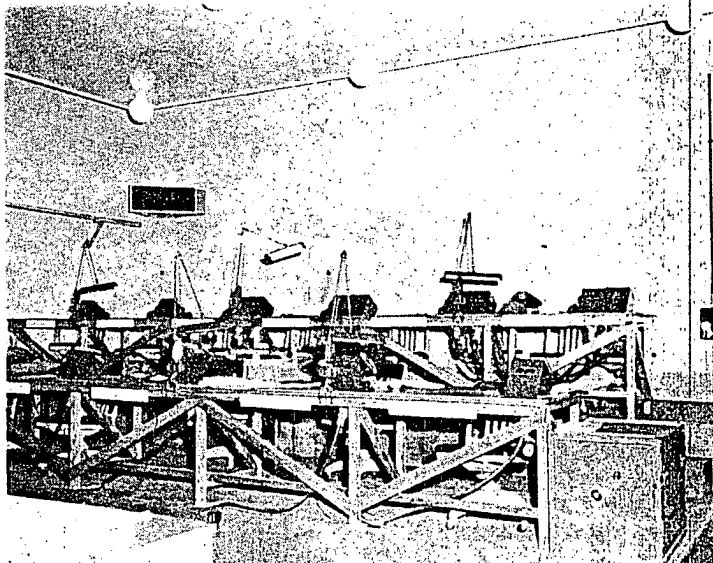
2. The water station designed for air-to-water recovery of the package by C-119 aircraft was inadequate. (S)

3. Ground termination stations are a mandatory back-up for other recovery techniques. (TS)

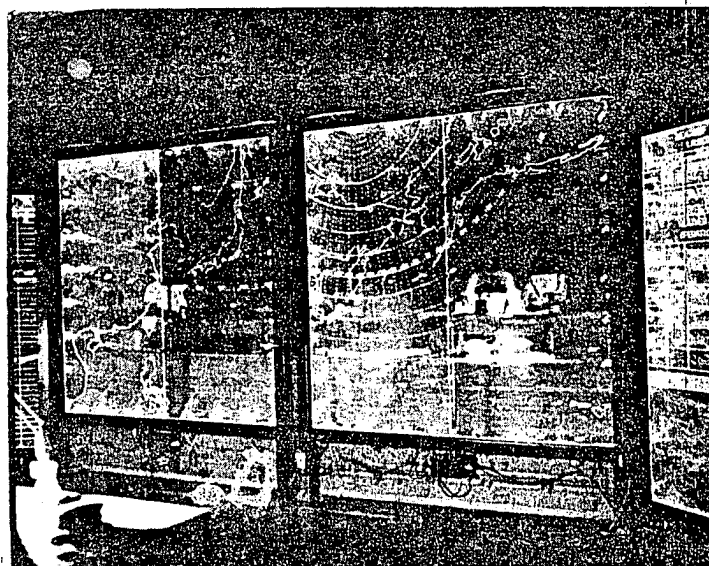
4. Surface recovery of all packages should be planned as the primary method of recovery with a suitable and fool-proof method of locating the package, such as a beacon capable of operating on land or water. (S)

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Recovery Control Center Staff Positions



Recovery Control Center Plotting Boards

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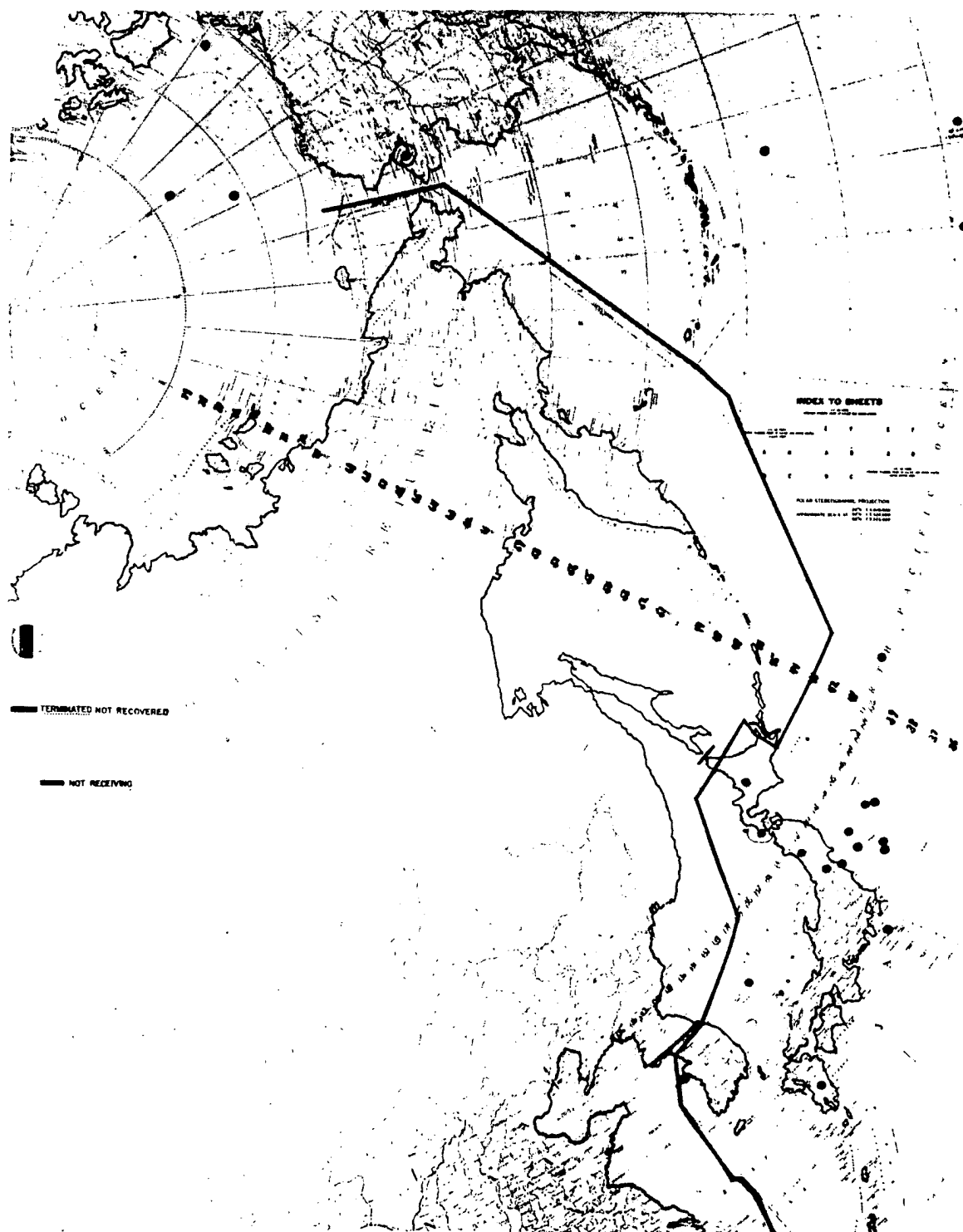
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Geographical Operating Restriction Line

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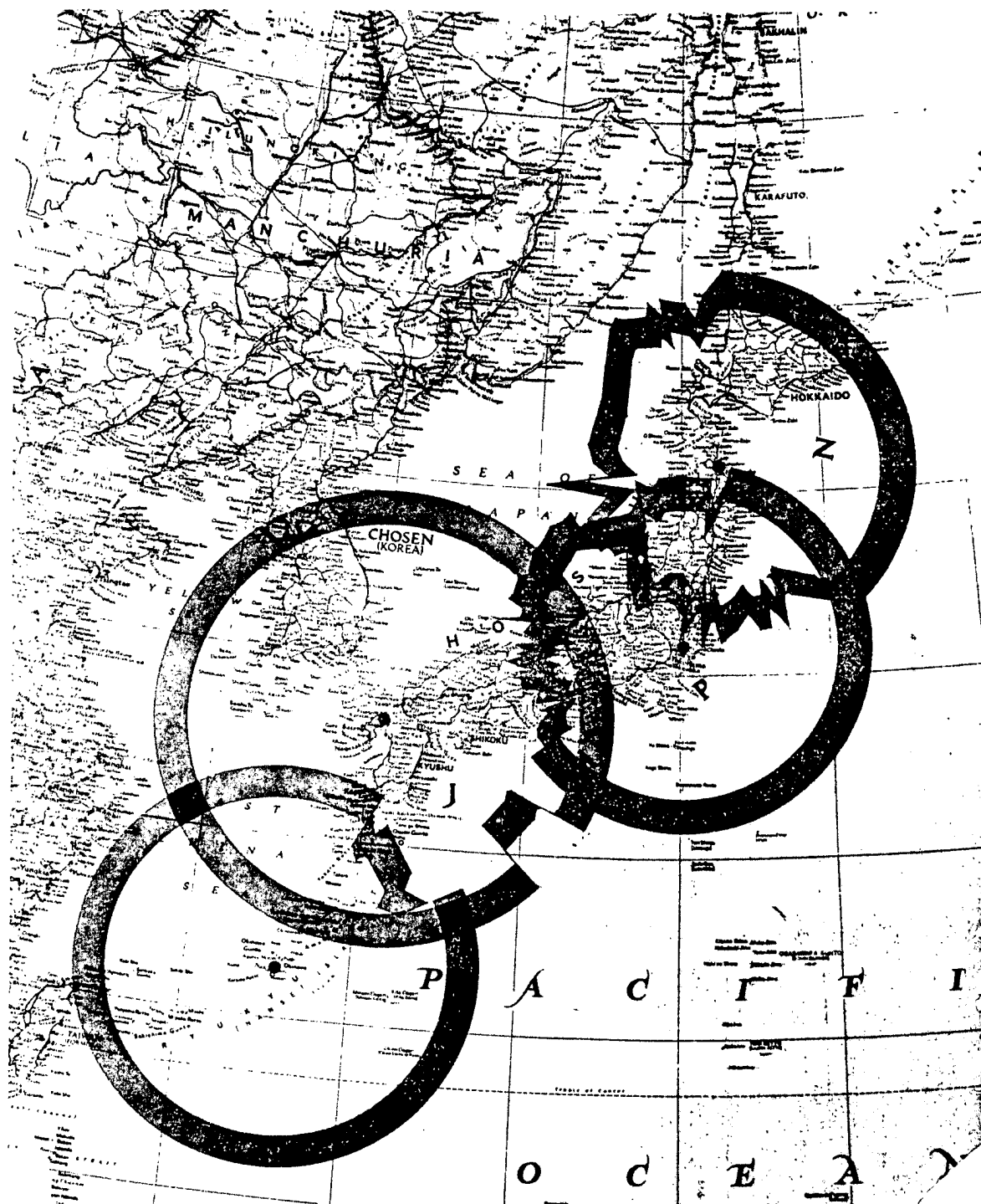
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Range of Far East Ground Cut-Down Stations

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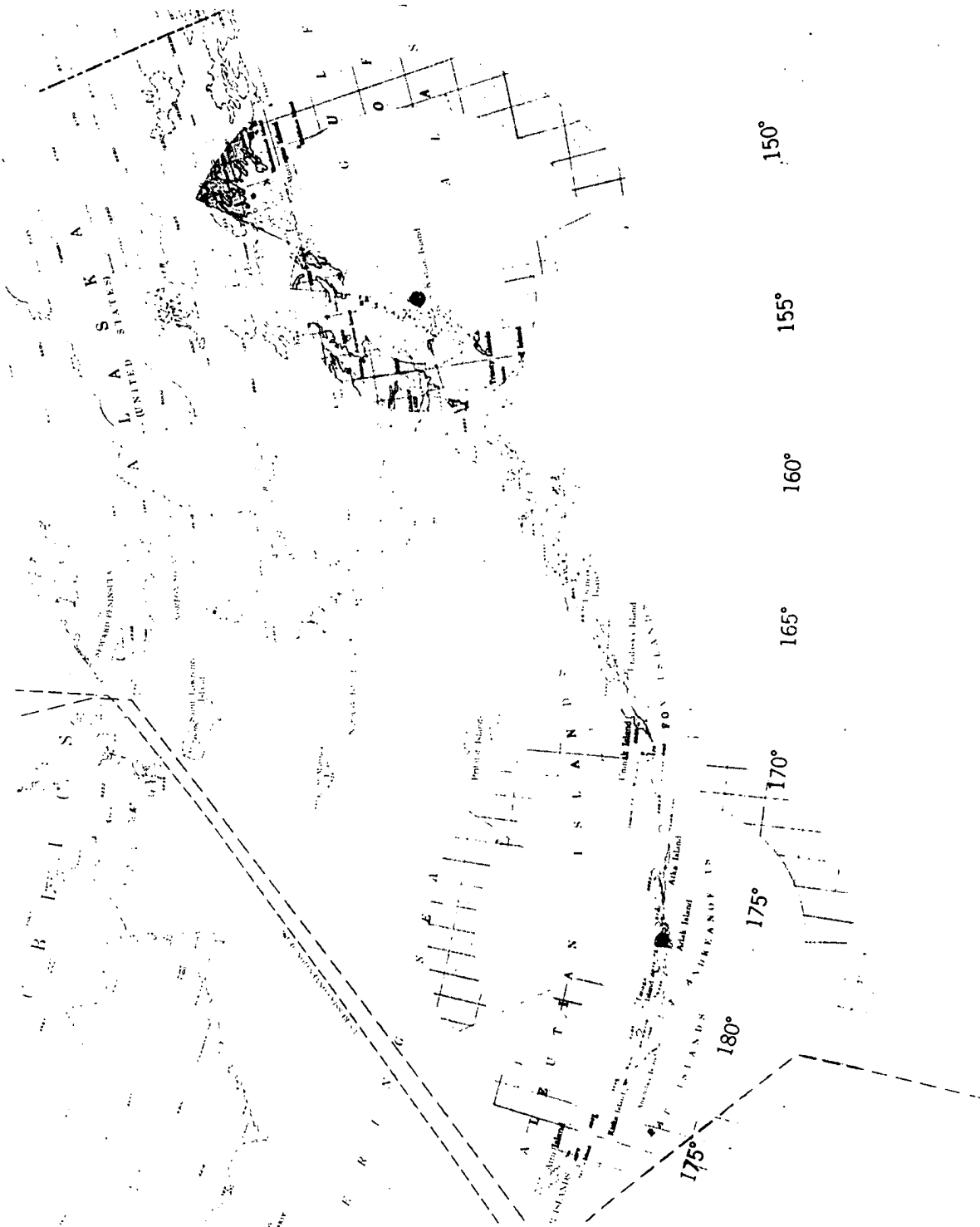
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Range of Alaskan Ground Cut-Down Stations

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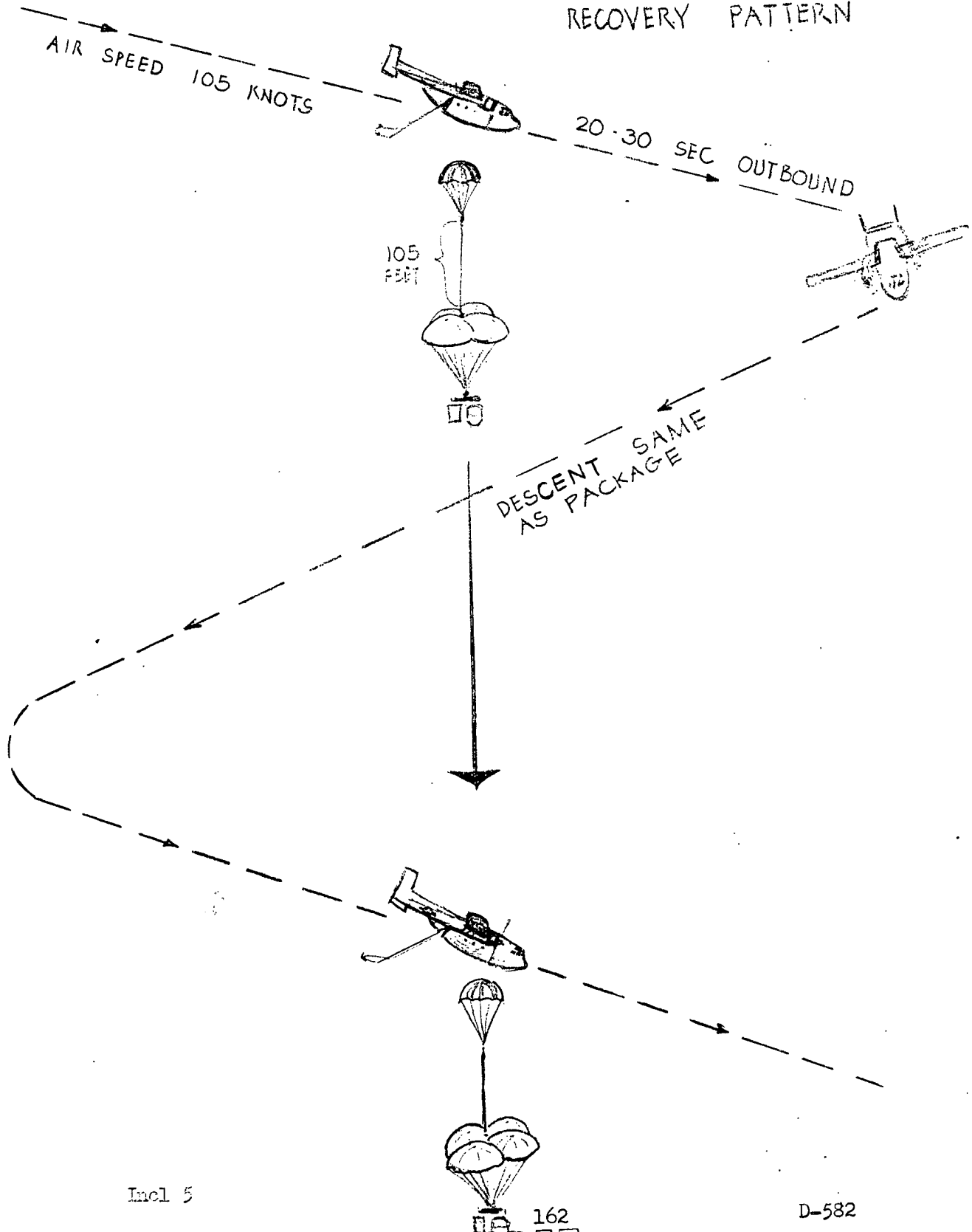
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TOP SECRET C-119 AIRCRAFT
AIR TO AIR
RECOVERY PATTERN



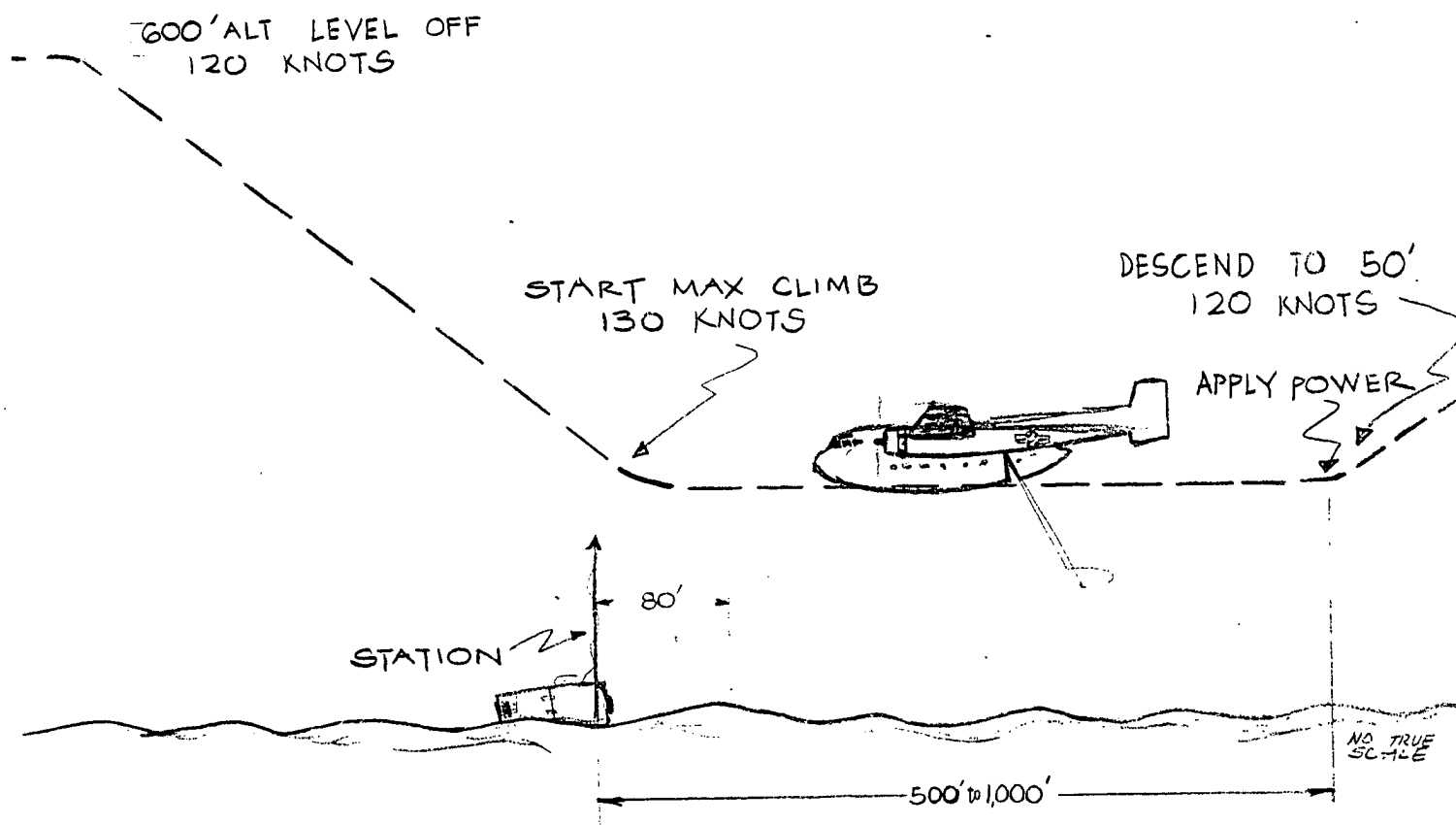
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C-119 AIRCRAFT
AIR TO WATER
RECOVERY PATTERN



Encl 6

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TAB H
CONTROL

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I. CONTROL

A. General:

1. During the conduct of this operation, command control was established at 1st Air Division Headquarters, Offutt Air Force Base, Nebraska, to actively control all phases of the project. Experience gained during the conduct of Moby Dick Hi led to standard operating procedures being established, staff functions outlined, and responsibilities of each component agreed upon. Through 1st Air Division Communications Network facilities outlined in Part II, Tab "C", all subordinate headquarters were interconnected to provide a rapid flow of orders, directives, reports and policy. Four control teams, composed of one officer and one airman per team, who were current in all phases of the operation, provided for operation of the Control Room on a 24 hour a day basis. Close coordination between all participating agencies further added to the positive control established by this headquarters. (C)

2. As a means of relaying the bulk of the essential data, a reporting system was established by which formats would be followed by both the launch and recovery units in the submission of certain data. Those periodic reports required for launch activities included Launch Recapitulations, Daily Status and Planning, Balloon Terminations, Recovery, and Gondola Dispositions. The recovery unit was responsible for the submission of Balloon Tracking Reports, Status of Tracking Sites, Recovery Recapitulations, and Gondola Dispositions. (C)

B. Control Facilities:

1. Launch Control Center. The launching phase of the mission was controlled by Commander, Detachment 1, 1st Air Division, through the Launch Control Center at High Wycombe, England. Launch criteria provided by this headquarters were compiled with by planning launch activities utilizing information on forecasts of balloon trajectories for proposed launches and surface weather conditions for each site. Daily reports on launches, failures, operational capabilities, limitations, technical data, and informational matters continually flowed between the Launch Control Center and the Command Post. Reports were submitted so as to be available to this headquarters at times when required staff action could most readily be accomplished. (C)

2. Tracking and Recovery. Because of the close association between tracking and recovery, this phase of the operation was combined under one Recovery Control Center

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located at Shiroy Air Base, Japan. Upon receipt of an initial balloon radio transmission, a series of reports would start flowing from the Recovery Control Center to the Command Post. The flow of information enabled **this** headquarters to follow the progression of events connected with each launch - - through tracking, termination, recovery and disposition. Daily status reports on aircraft, tracking sites, recovery bases, and recovery of downed gondolas also aided the commander in maintaining positive control and providing required guidance and assistance. (S)

3. Command Post. Located at Headquarters, 1st Air Division, the Command Post provided 24 hour, 7 days a week, control and surveillance of the entire operation. Reports were submitted in accordance with 1st Air Division Reports Manual 55-8. Through the use of display maps, wall charts, and historical records, each balloon flight was critically observed during its operational life. Recovered packages were followed until the end product was obtained. Analyses were continually made and the Reporting Manual modified to provide maximum control of the vehicle as well as the participating units. (C)

a. Daily command briefings included data on recent launches, balloons being tracked, recoveries, programmed activities, and running recaps of all phases of operations. (C)

b. Periodic reports were rendered to Headquarters United States Air Force as regards current activities and the progress of the mission. (C)

c. It required six officers and twelve airmen to man the Control Room for "around the clock" operations. Incoming reports were spaced time-wise so as to distribute the workload evenly throughout each 24 hour period. Tasks were governed by means of detailed Standing Operating Procedures and job assignments. It was necessary that control room personnel become familiar with all phases of balloon operations, and to adapt that learning to control room procedures and requirements. (U)

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TAB I

VULNERABILITY

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I. VULNERABILITY

A. Due to lack of information on the subject, it was decided during the early stages of Project Moby Dick Hi that tests should be conducted to determine the vulnerability of the system to unfriendly countermeasures. The Air Defense Command (ADC) was requested to participate and report their findings to this headquarters. Altitudes involved were 50,000 to 80,000 feet during daylight hours and 40,000 to 50,000 feet during hours of darkness. A radar reflector was attached to many gondolas to increase the radar flight-following capability of the Radar Bomb Scoring Detachment located adjacent to the launch site at Lowry AB, which in turn should have increased the capability of ADC radars to detect the system. Only a few of these vehicles were equipped with the water station, which is a dipole of token (Soviet) radar. In addition, Headquarters ADC was provided information on the date and time of each launch, termination information if failure occurred, and progressive position reports of balloons during flight. Balloon launchings commenced on 11 May 1955, but no positive detections were made by ADC forces until late July 1955. Of all (83) balloons having a flight duration of two hours or more, ADC detected 25% by all means (radar, GOC, aircraft reports). Even though a favorable situation for detection was created by the radar reflectors, launch time information, and continuous position reports, only 14% were detected by radar. This led to the conclusion that the system was not unacceptably vulnerable to detection. Visual sightings by ADC Ground Observer Corps during the vulnerability testing was equal to and sometimes exceeded sightings obtained by radar. A foregone conclusion, borne out by results of the vulnerability test, and also previous tests by Air Proving Ground (APG), was that fighter aircraft could terminate balloon flight, provided they were capable of attaining the altitude of the balloon within range of installed armament. (TS)

B. Of all (88) Moby Dick Hi balloons having a flight duration of 2 hours or more, three-fourths (66) floated at approximately 80,000 feet during daylight hours. However, during primary mission operations, balloons were restricted to a maximum altitude of 55,000 feet in daylight by higher headquarters. Reference Chapter I, Section IV, paragraph D3. (TS)

C. During the Moby Dick Hi vulnerability test, ADC "S" band radars were capable of tracking balloons to a limited extent. During primary mission operations, 12th Air Force radars were capable of tracking balloons at high altitude and at ranges up to 150 nautical miles. The Soviets are known to have large numbers of "S" (300 MC) and "P" (70 MC) band radars. The main suspension bar and water station assembly of the system were the proper length to furnish maximum return to the "P" band radar. (TS)

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D. The radio frequencies used in the operational balloon HF transmitters fell within the frequency range of modified German Krug and Wullen-Weber automatic HF/DF stations. The Soviets have installed this equipment and are believed to have attained a high degree of proficiency in its operation. It is assumed that they were able to obtain positions of transmitting balloons accurately enough to alert the radar and fighter forces. The Soviets are known to have an extremely active ground observer corps, which is probably well integrated into their air defense system. Position reports of balloons from the ground observer corps are believed to have supplemented the positions obtained by Soviet HF/DF stations and radar network. (TS)

E. An estimate of the Soviet Air Order of Battle indicates approximately 10,000 jet fighter aircraft having the capability of reaching between 56,000 and 59,000 feet of altitude. The floating altitude of project balloons was set between 40,000 feet at night and 54,000 feet during hours of daylight. The period during which the system is believed to have been most vulnerable to fighter attack should have been that of dawn and twilight, as, at these times the balloon was at its lowest altitude and illuminated by slanting rays of the sun. However, the analysis of ballasting performance (see Tab N, this chapter) indicates that the system did not adhere to the expected profiles and ballasting rates, but descended to lower, more vulnerable, altitudes during daylight hours. This departure from the expected was unknown until subsequent to termination of the project. The fact that the recovered balloons spent approximately three quarters of their lives at the lower altitudes forces the conclusion that most balloons performed in a like manner. It is further concluded that this probably contributed greatly to the loss of balloons to intercepting aircraft. (TS)

F. An exact statement as to vulnerability of the 119L system balloons during primary mission operations is not possible, due to limited information. However, the fact that several balloon systems were displayed in Moscow on the 9th of February 1956, seems to indicate that not only were the Soviets cognizant of the operation, but were sufficiently well organized to terminate and recover the the displayed systems from within their borders between the dates of 10 January and 9 February 1956. (TS)

G. The report covering the vulnerability test conducted during Project Moby Dick Hi, is contained in the Final Report of Operational Suitability Test Project 119L. Vulnerability is further discussed in Chapter I, Section VI, paragraph C and Chapter III, Tab R, paragraph G. (S)

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TAB J

ANALYSIS OF DM.-1

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I. ANALYSIS AN/DMQ-1. (Photo Reconnaissance Package)

A. During September 1955 a manual (Procedures and Techniques for Data Recovery) was prepared and distributed to instruct recovery agencies on procedures to follow in preparing recovered packages for shipment to the ZI. No requests for further guidance were received from supporting agencies. (C)

B. Procedures for return of recovered packages were mutually outlined and agreed upon by participating commands. These procedures were then published in 1st Air Division Operations Order 250-55. (C)

1. In the Far East, packages were delivered by FEAF to Northern Air Materiel Area, Pacific, for inspection, crating and shipment to the MATS terminal at Haneda. MATS then delivered packages from Haneda to Travis AFB, California. The Air Transportation Coordinating Officer at Travis AFB shipped packages by AMC LogAir to Norton AFB and notified the 15th Reconnaissance Technical Squadron of estimated time of arrival at Norton. The 15th Reconnaissance Technical Squadron picked up packages at Norton AFB. (S)

2. Packages from the Alaskan area were delivered by Alaskan Air Command to the MATS terminal at Elmendorf AFB. MATS then delivered packages to ATCO at McChord AFB who shipped them by AMC LogAir to Norton where they were picked up by the 15th Recon Tech Sq. (S)

3. Packages recovered in areas other than FEAF and AAC were returned under a USAF "Stray Recovery Program". The Air Attache was the principle person involved in recovery of these packages. It was his responsibility to see that they were shipped to the ZI via theater and MATS aircraft. Packages recovered East of Dhahran were delivered by AMC LogAir from Brookley AFB, Alabama or Dover AFB, Delaware to the 8th Recon Tech Sq at Westover AFB, Mass. (S)

C. Procedures as outlined, proved to be both effective and expeditious. Few problems were encountered and these were resolved with minimum delay. Time delays experienced are as follows:

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	Total Re- Turned	Average Elapsed Time in Theater	Time from Arrival at MATS Termi- nals to ZI	ZI Time from 1st ZI Base to RIS	Average Total Trans- portation Time
FEAF	41	42 hours	60 hours	15 hours	4 days 21 hrs
AAC	1	4 hours	13 hours	36 hours	3 days 1 hr
Europe	* 3	10 days	52 hours	32 hours	12½ days (C)

* Collected and returned by the Headquarters "Strap" plan which established reporting procedures whereby 1st Air Division was kept informed of status of material being returned to the 3th Reconnaissance Technical Squadron. (TS)

D. Of 42 DMQ-1 packages recovered and processed, as of 26 February 1956, four (4) had aborted. Three of these four missions never activated. Bench check of the recovered gear and inspection of the processed film revealed that these DMQ-1 packages had never received trip pulses. Indications are that these system failures cannot be attributed to the camera system. The remaining abortive mission was due to improper duplex camera action, however, there is evidence that this malfunction occurred during ground pre-flight check and with closer observation would not have been flown. (TS)

E. In addition to the four (4) aborts, photography obtained from six (6) additional missions showed serious malfunctioning of the DMQ-1 equipment. These malfunctions resulted in an approximate average loss of 2 days of photography per mission. Specific causes of these malfunctions are not known, however, the following abnormal conditions were noted during inspection of the processed film and recovered gear: (S)

1. Several instances of improperly timed trip pulses being sent to the DMQ-1.
2. Loose wires and nuts in the control junction box.
3. Electrical wire insulating material interfering with camera cycle.
4. Improper linkage adjustment on shutter cocking system for the Eastman camera.
5. Duplex camera not properly installed in mounts prior to flight. (S)

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F. The DRS-1 modification to limit system operation to daylight hours worked satisfactorily. Only 4 packages were recovered which had been modified to provide a separate Q-1 power source. These systems operated normally. (C)

G. Condensation of moisture on the inside of the data recorder hazel port obscured the desired image on approximately 50% of the total hazel film processed. Inconclusive evidence indicates that this condensation may not occur to an excessive degree when the desiccant seal has been punctured. This procedure was initiated during the project. (S)

H. All photo coverage received by Aeronautical Chart and Information Center as of 1 March 1956 has been successfully plotted. The following is quoted from a report on an evaluation of the geographic positions computed by Aeronautical Chart and Information Center from hazel data: (S)

"1. Computed hazel coordinates were compared to final photo indexed coordinates and differences of position recorded. Results were grouped as follows:

CATEGORY I Computations with less than one degree error.

CATEGORY II Computations with less than two degrees error (includes CATEGORY I).

CATEGORY III Computations with less than three degrees error (includes CATEGORIES I and II).

CATEGORY IV Computations with less than four degrees error (including CATEGORIES I, II and III).

"2. A total of eighty computations were compared and the percentage that fell within each category was as follows:

CATEGORY I 66%

CATEGORY II 34%

CATEGORY III 95%

CATEGORY IV 98%

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- "3. The accuracy of hazel computations depends on the ability to determine the sun's maximum altitude and also on the time obtained when the sun altitude is read as zero. On several of the missions screened, this was not possible for one or more days of flight because of blurred or distorted hazels. Therefore, the coordinates obtained would have to be considered as approximate. Any methods used to obtain the computed positions are applicable to DMQ-2 missions. Results could be refined somewhat by additional methods, i.e., lines of position, azimuth curves and analysis. Comparison of photo plot and computed track, simulating DMQ-2 mission from actual flight data available, is being made. Results will be forwarded when completed." (S)

SYSTEM PERFORMANCE RECAP - DMQ-1

Site	Duplex Model	Recovered and Processed	Serious Malfunctions	Aborts	Approximate Net Success
Det 1	Fairchild	6	0	1	5
Det 2	Eastman	29	5	3	23½
Det 3	Bill Jack	0	0	0	0
Det 4	Chicago	1	0	0	1
Det 5	Hycon	6	1	0	5½
	Totals	42	6	4	35

NOTE: Three (3) additional stray DMQ-1 packages whose flight was terminated prior to camera system activation were recovered and processed. (TS)

I. Photography.

1. Characteristics of Photography.

a. Reconnaissance photography obtained from primary mission consisted of opposite 9" x 9" low oblique photographs exposed simultaneously from a duplex camera with two 6" retrogon lens rigidly mounted at an angle of 34½ degrees from the vertical with 5% overlap between opposites. Average flying altitude of the balloon borne vehicle was approximately 45,000 feet above mean sea.

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level producing an average span of 38 to 47.5 nautical miles. Exposures were taken continually every $6\frac{1}{4}$ minutes from sunrise to sunset. The camera was activated by a photo-electric cell when the intensity of the light was above 70 foot candles. Vehicle rotation was pre-set at $22\frac{1}{2}$ degrees between $6\frac{1}{4}$ minute exposures, however, random rotation resulted in deviation up to 180 degrees between consecutive exposures. Ground speed of vehicle varied from extremes of 25 to 170 knots. Definition and resolution of detail in photography obtained was good to excellent. (See sample photo, Inclosure 4, this Tab.) (TS)

2. Usability and Limitations of Photography.

a. The aeronautical Chart and Information Center in St. Louis, Missouri, had the responsibility for plotting the aerial coverage from the mission and producing photo indices, time and altitude profiles, intelligence reports, and target mosaics and related graphics. (TS)

b. Detailed photo interpretation and preparation of intelligence reports were accomplished from both contact prints of duplex pairs and transformed prints rectified to a vertical plane. Detail on transformed prints was distorted and diffused and offered very limited stereo fusion. The majority of intelligence was gained direct from contact prints limited only by small scale and oblique angle. This type of photography affords an excellent source for pioneer reconnaissance but due to limiting factors mentioned above, detailed analysis of new intelligence is difficult. (TS)

c. Target charts and mosaics of acceptable accuracy can be produced from this photography limited only by small scale and distortion inherent in rectification and restitution of oblique photography. (S)

3. Distribution of duplex film from primary mission. (S)

SAC Processing Recon Technical Squadron

- 1 master positive
- 1 duplicate negative

All other SAC Recon Technical Squadrons

- 1 duplicate negative

ACIC, St. Louis, Missouri

- 1 original negative
- 1 duplicate positive
- 1 duplicate negative

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PR&SD, ACIC, Washington, D. C.

4. Summary. (TS)

- a. Total number of missions - 40 (plotted by ACIC as of 30 March 1956).
- b. Total number of exposures 17,131.
- c. Total number of usable exposures - 13,813.
- d. Square statute miles of charting photography:
 - (1) Gross for project - 1,984,173.
 - (2) Net for project - 1,661,869-equal to 51% of continental United States.
 - (3) Gross for Sino-Soviet area - 1,388,745.
 - (4) Net for Sino-Soviet area - 1,116,449 - equal to 37% of continental United States or - approximately 8% of Sino-Soviet area.

NOTE: Gross figures do not include cloud cover. Net figures eliminate duplicate cover.

5. Inclosure 1 to this Tab depicts the photo coverage obtained from the first 40 systems processed through Aeronautical Chart and Information Center. Inclosure 2 contains photographic processing information provided by ACIC. Inclosure 3 illustrates the intelligence reports produced as of 23 March 1956, by the SAC Reconnaissance Technical Squadrons. These reports cover significant installations (RT-53) and airfields (RT-55) in the Sino-Soviet area. (TS)

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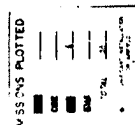


Photo Coverage obtained from the first 38 systems plotted

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PROCESSING

Flight Number	Aerial Camera		Hazel Unit (16mm)	
	Feet of Film Exposed	Number Discernible Frames Received	Feet of Film Exposed	Number Exposures Received
CBE - 4	15	2	.03	3
CBE - 8	350	920	15.0	461
CBE - 14	720	819	11.0	409
CBE - 32	490	600	7.5	309
CBE - 55	570	643	8.0	321
CBE - 57	<u>796</u>	<u>973</u>	<u>12.17</u>	<u>439</u>
Sub-total	3,441	3,967	53.75	1,992
ADA - 3	400	453	6.5	231
ADA - 4	500	463	6.5	204
ADA - 6	140	136	3.0	253
ADA - 7	500	513	6.5	257
ADA - 23	50	0	0.5	21
ADA - 29	230	270	4.3	173
ADA - 34	360	390	10.0	200
ADA - 36	316	376	4.3	133
ADA - 40	900	283	6.0	237
ADA - 44	350	312	10.0	151
ADA - 47	320	362	4.5	133
ADA - 43	330	332	5.5	224
ADA - 52	320	344	4.5	174
ADA - 53	40	0	4.5	177

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PROCESSING Cont'd

Flight Number	Aerial Camera		Hazel Unit (16mm)	
	Feet of Film Exposed	Number Discernible Frames Received	Feet of Film Exposed	Number Exposures Received
ADA - 54	350	401	5.0	200
ADA - 56	312	340	3.7	146
ADA - 58	100	39	3.3	134
ADA - 60	200	284	3.3	145
ADA - 61	250	286	3.5	141
ADA - 62	320	352	4.3	172
ADA - 66	900	39	4.4	173
ADA - 67	280	343	7.0	Unknown
ADA - 69	350	202	13.0	539
ADA - 77	336	432	5.3	215
ADA - 85	310	354	4.4	175
ADA - 87	150	0	0.0	0
ADA - 88	460	345	5.0	203
ADA - 89	381	460	5.5	227
ADA - 91	284	234	4.3	178
ADA - 142	<u>436</u>	<u>524</u>	<u>4.2</u>	<u>253</u>
Sub-total	10,725	9,035	157.9	5,594
EVA - 50	<u>900</u>	<u>1,006</u>	<u>12.5</u>	<u>493</u>
GIE - 1	370	963	12.6	492
GIE - 10	900	312	14.0	411
GIE - 23	290	219	9.35	394

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PROCESSING Cont'd

Flight Number	Aerial Camera		Hazel Unit (16mm)	
	Feet of Film Exposed	Number Discernible Frames Received	Feet of Film Exposed	Number Exposures Received
GIE - 31	570	670	7.5	304
GIE - 32	460	498	6.0	242
GIE - 51	900	913	13.0	455
GIE - 102	<u>593</u>	<u>700</u>	<u>10.0</u>	<u>360</u>
Sub-total	4,533	4,785	72.95	2,658
Grand Total	19,649	18,793	297.10	10,742

The above flights covered the programmed area and the film received was processed by the 15th Reconnaissance Technical Squadron. The three aborts were ADA-28, ADA-53, and ADA-37.

ADA - 2	22	0	3.0	127
ADA - 43	22	0	1.7	66
ADA - 64	*	*	*	*
ADA - 68	40	1	2.0	5
ADA - 73	*	*	*	*
ADA - 111	40	0	1.7	44
GIE - 79	<u>14</u>	<u>0</u>	<u>1.17</u>	<u>0</u>
Total	138	1	9.57	242

The above flights did not cover the programmed area and the film received was processed by the 3th Reconnaissance Technical Squadron. The processing reports for ADA-64 and ADA-73 were sent to ACIC and not received in this Headquarters.

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RT-55

•TASHTAGOL USSR



CHING TAO SOUTH CHINA
SPORT FACILITIES
HAMHUNG COMPLEX, N KOREA
HSIAO-I-CHEN, CHINA

● ROSTOV EAST AF, USSR	CONFIDENTIAL
● RANETS AF, SUGLA A	CONFIDENTIAL
● BURGAS AF, BULGARIA	CONFIDENTIAL
● HU HSIEN AF, CHINA	CONFIDENTIAL
● KANSK AF, USSR	CONFIDENTIAL
● WU-KUNG AF, CHINA	NEW
● SO-CHE AF, CHINA	CONFIDENTIAL
● SDOER AF, ALBANIA	CONFIDENTIAL
● POWIDZ AF, POLAND	CONFIDENTIAL
● TANG YANG AF, CHINA	CONFIDENTIAL
● LIN-FEN AF, CHINA	CONFIDENTIAL
● BRYSK EAST AF, USSR	CONFIDENTIAL
● TUNG-HAI AF, CHINA	CONFIDENTIAL
● KAO-MI AF, CHINA	CONFIDENTIAL
● CHENG-HSIEN NE AF, CHINA	CONFIDENTIAL
● KAN-TZU AF, CHINA	CONFIDENTIAL
● LIU-TING AF, CHINA	CONFIDENTIAL
● KUANG-HAN AF, CHINA	CONFIDENTIAL
● CHI-NAN AF, CHINA	CONFIDENTIAL
● CHONG-JIN NO I AF, N KOREA	CONFIDENTIAL
● WEI-HSIEN AF, CHINA	CONFIDENTIAL
● TU-MENG-YA AF, CHINA	CONFIDENTIAL
● TSING-TAO SEAPLANE STA. C	CONFIDENTIAL
● TSING-TAO AF, CHINA	CONFIDENTIAL

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Sample Project Photograph

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TAB K

DISCUSSION OF DMQ-2

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II. DISCUSSION OF DMQ-2 (FERRET EQUIPMENT)

A. The AN/DMQ-2 was a device intended to automatically intercept and record electronic emission in the frequency spectrum from 1000 mc to 40,000 mc. Activation of various patterns of lights within the system by the intercepted emissions was intended to expose a pattern of dot images on film which could be interpreted to discern Radio Frequency, Pulse Width, Pulse Repetition Frequency, Polarization, Sweep Rate and D/F information. The system was designed to record 16,000 emissions at a rate of four per minute. (TS)

B. The overall configuration of the gondola was approximately equivalent to the DMQ-1. Manufacture of this complex equipment into a relatively small chassis and a restriction of power consumption to 6 watts per hour, precluded the use of standard electronic tubes and components. Transistors and printed circuits were used throughout the equipment. The critical temperature of the transistors in the system was discovered to be 50 degrees Fahrenheit. The electrical characteristics of the transistors changed when the internal temperature of the gondola dropped below this point. This discovery was made during the acceptance tests at Rome Air Development Center. Continued random failures within the system prevented delivery during this project. (S)

C. Coincident with the design of the AN/DMQ-2, an automatic data reduction device, REDACE (Reconnaissance Electronic, Digital, Analog, Computer, Electronic), was designed and built. REDACE provided readout or data reduction of the film at a rate of 400 emissions an hour and presented the data in printed format and International Business Machine (IBM) cards. (TS)

D. The design of the AN/DMQ-2 and REDACE as an automatic intercept, analysis, D/F and data reduction system is unique in that this was the first attempt of complete automation of a ferret system. (TS)

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TAB L

INFORMATION SERVICES

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I. INFORMATION SERVICES

A. The initial concept for primary mission cover plan was established by Headquarters United States Air Force. This cover plan was to establish the project as an unclassified Meteorological Survey program. It was not the intention to widely publicize the operational phase, instead the operation would commence as scheduled and the cover plan would be used as counteraction for any protests that might be received from foreign governments. (TS)

B. It was considered highly advisable to protect any reference as to the use of cameras in the system gondola. The connection between a European launch and a Far East aerial recovery capability or acknowledgement of an aerial reconnaissance capability were considered the most likely areas for project compromise. (TS)

C. The responsibility for development, publication and monitoring of the cover plan was vested, initially, in Headquarters 1st Air Division. The concept was expanded and published as an annex to Headquarters 1st Air Division Operational Plan Project (codeword) dated 10 June 1955. This publication provided guidance for applicable personnel as to the areas that could be discussed. Sample press releases were provided for each activity and for the various phases of the project i.e., during Continental United States (CONUS) operation, deployment, at forward sites, etc. (S)

D. It was emphasized throughout that no voluntary releases would be made, and when required, the unit concerned would forward a proposed release to Headquarters 1st Air Division for approval. When questioned directly, unit personnel would divulge only, but freely, the unclassified meteorological aspect of the mission. With the free discussion of the meteorological aspects, but a tight control on news media publication, a sound framework was established whereby the project could be explained as a routine operation and not considered new or important enough for a large fanfare of publicity. (S)

E. On or about 27 December 1955, Headquarters United States Air Force, verbally requested Headquarters 1st Air Division representatives to attend a conference pertaining to policy change of the Public Information aspects of the cover plan. It was revealed that the policy on news releases was being changed to insure wide dissemination of this project as a part of a continuing world wide meteorological project. Headquarters United States Air Force assumed responsibility for making the initial world wide press release concurrent with commencement of operations. Public information aspects generated by this initial release were to be handled by applicable theater commanders or Department of State Representatives to insure lateral coordination at high government levels as applicable. (TS)

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F. This policy change was established and disseminated by publication of Headquarters United States Air Force Public Information Brochure on or about 5 January 1956. (U)

G. On 9 February 1956, Headquarters United States Air Force unclassified message SAFIS-3 160/56, advised of a second change in policy. Effective with receipt of this message all Public Information queries would be referred to the Department of State. This change in policy was immediately disseminated by Headquarters 1st Air Division teletype message and subsequently as an amendment to 1st Air Division Operations Order 250-55. (S)

H. For information purposes, sample copies of news releases in Zone of Interior, Europe and Far East are contained on subsequent pages. (U)

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Weather Balloon Program Is Expanded

Washington (AP)—The Air Force said Monday it is augmenting its high altitude weather balloon program with the hope that it will help explain the cycle of floods, dust storms and hurricanes which now batter the nation.

The use of huge "Moby Dick" weather balloons hitherto has been confined to the United States. But Monday's announcement said the program is being expanded "to include other areas in the Northern Hemisphere."

A spokesman said this would include Alaska. Some balloons sent up from there presumably would drift eastward into Canada before disintegrating into harmless fragments at altitudes ranging from 30 thousand to 200 thousand feet.

Additional research balloon stations also will be set up in Europe and Hawaii during 1956, the announcement said.

The Air Force said the expanded program would be of "great use in the International Geophysical Year during 1957-58." In that year, two score nations will join in gathering a vast amount of information about weather, terrestrial magnetism, earthquakes, oceanography and other geophysical data.

The giant plastic balloons—which carry weather instruments, cameras and equipment registering cosmic rays and other data which is radioed automatically to ground stations—"often have been mistaken for 'flying saucers,'" the Air Force said. It added that:

"Balloons are, in effect, miniature 'satellites' that can remain aloft for several days and thereby collect continuous research."

The earth satellites which the United States and Russia plan to launch for the geophysical year will orbit hundreds of miles above the

earth for several weeks before returning to the atmosphere. In their swift descent they will disintegrate before reaching the ground.

"This program," said the Air Force announcement, "is designed to obtain simultaneous meteorological observations in the Northern Hemisphere. It is expected that new information will be obtained on jet-streams, frontal systems, storm formations, electro-magnetic radiation and radio propagation."

The jet stream is a layer of air encountered at varying heights and moving in varying paths at speeds as high as three hundred miles an hour. There has been scientific speculation that a southward shift in the jet stream may account for the inland movement of hurricanes in recent years.

A "frontal system" is the leading edge of a cold or warm area which moves across this country.

Balloon With Trio in Basket Lands, Exciting S. D. Town

Mitchell, S. D. (AP)—A large plastic balloon carrying three men in a canvas gondola brought mystery and excitement to a quiet farming community near here Monday when the balloon landed after a 50-mile low-altitude meteorological flight.

The balloon, launched by General Mills, Inc., Minneapolis, researchers in co-operation with the Office of Naval Research, was sent aloft at the Huron, S. D., Airport about 1:30 p. m. Monday.

It came down about three hours later near Fulton, S. D., four miles east of Mitchell.

In Minneapolis, Marshall Keith, research resident, Office of Naval Research, said

the crew kept the balloon below the overcast, attaining an altitude of about 1,500 feet. Studied with instruments were temperatures, wind and pressures as well as rays.

Other similar flights are planned, Mr. Keith said. They are believed to be the only ones in the nation currently carrying men.

The pear-shaped balloon was 34 feet in diameter and about 60 feet high when inflated with helium.

J. R. Smith, Minneapolis, one of the General Mills researchers aboard, described the flight as uneventful and pleasant because of the extreme quiet.

Weather Balloon's Origin Mystery

The shiny object hovering over Omaha late Monday afternoon was a weather balloon but where it came from is a mystery.

Air Force planes identified it and placed its altitude at about 31 thousand feet.

The Omaha Weather Bureau didn't know who released the balloon, which was moving east-southeast.

All clippings from
Omaha world Herald
10 Jan 56

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TOP SECRET**AF Balloon
Reward Set**

TOKYO (FEAF)—In connection with the recent U.S. Air Force announcement that it was augmenting its high altitude weather balloon program, Far East Air Forces announced Saturday a reward for the return of balloon-launched meteorological instruments used in the weather research program.

It was decided to offer a reward for the return of such equipment when it was learned that a Japanese fishing boat had found meteorological instruments at sea but had thrown them overboard.

THUS VALUABLE equipment as well as data recorded on the instruments has been lost. It will be recalled that the U.S. Navy launched a weather balloon from Oppama, near Yokosuka Naval Base, this week which later came down at sea. The valuable meteorological instruments and data were lost.

The reward, the equivalent of \$25.00, will go to the person or persons reporting the location of such instruments to the nearest U.S. military installation or to the Japanese police.

Gondolas carrying the delicate recording instruments are automatically detached from the plastic balloons and parachuted down several days after launching. Persons reporting the location of these instruments will be permitted to keep the parachutes

in addition to receiving the reward.

The instruments are used in the meteorological research program announced recently by FEAF and Air Force headquarters in Washington.

SITES IN THE Far East have been established for launching the balloons. Air Force officials have pointed out that the gondolas are harmless and contain nothing dangerous.

However, persons finding the gondolas are requested not to open or tamper with them as the data recorded on the instruments may be destroyed. Recovery teams will pick up the instruments.

The important research program is a continuation of the U.S. Air Force studies in wind patterns and upper air trajectories at altitudes between 30,000 and 40,000 feet.

Saturday, Jan. 21, 1956**2nd U.S.-Bound
Balloon Launched**

YOKOSUKA, Japan (CNFE)

—The second weather balloon in the U.S. Navy's experimental Transosonde Project was launched from the Oppama Naval Air Facility at 7:17 a.m. Saturday morning.

The launching occurred without incident.

The first balloon in the project was launched Tuesday. Friday the Navy reported that it was down at sea about 600 miles from the Hawaiian Islands.

Release of the third balloon is scheduled for Sunday morning. All the balloons are aimed at the U.S.

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Pacific Stars & Stripes
21 Jan 56

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Halt U S. 'Spy' Balloons Russ Tell West Germans

MOSCOW, Feb. 6 (AP)—The Soviet Union today demanded that the government of Western Germany take measures to prevent launching of American balloons from its territory.

A note handed by Soviet Ambassador Valerian Zorin to West German State Secretary Walter Hallstein in Bonn said "the government of the German Federal Republic is responsible for the actions of the American organs which launch balloons from its territory

"All of the consequences of this action lay on the shoulders of the German Federal Republic."

The note to West Germany followed similar protests to the U.S. and Turkey alleging the balloons

were on aerial photography reconnaissance flights.

The note said West German Chancellor Konrad Adenauer had promised Soviet Foreign Minister Vyacheslav M. Molotov during his Moscow visit last fall he would take up the balloon question with the U.S.

It went on to say that after this "the flights over the Soviet Union had not ceased but increased in number."

The note declared "the government of the USSR insists that the German Federal Republic take certain measures to prevent United States organizations from launching balloons from its territory."

A Soviet note, published last night by the official news agency Tass, also complained the U.S. has done nothing to halt the launching of propaganda balloons by private American organizations.

The Soviets have protested before over the propaganda balloons, but the new note contained the

(Cont. on Page 24, Col. 1)

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Soviet Protests To Bonn Over 'Spy' Balloons

(Continued from Page 1)

first mention of balloons allegedly sent by the U.S. military.

Tass said the note was handed to U.S. Ambassador Charles E. Bohlen Saturday by Soviet Deputy Foreign Minister Andrei A. Gromyko.

The note complained of "the launching by United States military organs from the territory of Western Germany, and also from United States air force bases situated on the territories of several nations bordering on the Soviet Union, of balloons into the air space of the USSR.

The note charged the use of such balloons constitutes a "gross violation of Soviet air space . . . contrary to obligations assumed by the U.S. Government in accordance with the UN Charter and incompatible with normal relations between states.

"The Soviet Union presents a decisive protest and demands that the Government of the United States take measures for the prompt cessation of the impermissible activity of the American military organs."

There was no explanation of how photographs taken by automatic cameras attached to the free balloons could be returned to American authorities.

U.S. Expected to Reject Soviet Balloon Protest

From Press Dispatches

WASHINGTON, Feb. 6 — The State Department today was expected to reject a Russian protest alleging that the U.S. has sent "propaganda balloons," some equipped with aerial cameras and radios, over Soviet territory.

A State Department spokesman said the U.S. does not release "propaganda balloons" for flight over Russia or anywhere else in the world. He said private groups in West Germany have released such balloons in the past.

The State Department spokesman indicated the protest apparently referred to high altitude weather balloons.

USAFE Hq Declines Comment on Balloons

WIESBADEN, Germany, Feb. 6 (AP)—USAFE Hq had no comment today on a Russian protest that U.S. military organizations are sending fleets of radio and camera-equipped balloons over Russian territory.

"This is a State Department affair and we have nothing to say," a spokesman said. The spokesman, however, drew attention to an announcement the Air Force made a month ago.

At that time, the Air Force said that "small research stations" were being activated "for the purpose of launching high-altitude meteorological balloons used to explore atmospheric conditions at altitudes above 30,000 feet."

"These large plastic balloons will carry meteorological instruments, including cameras to photograph clouds and radio equipment to record and telemeter atmospheric information," the January announcement said.

"The research stations are additions of the USAF program for high-altitude meteorological research which has been operating for several years. This program is being carried out in the spirit of the forthcoming International Geophysical Year.

"The stations in Europe will continue previous Air Force research into wind patterns, air turbulence, cloud formations and the effects of cosmic radiation and other weather phenomena at high altitudes," the announcement said.

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Balloon Data Ban Imposed

Quarles Put Under Dulles Pressure

Washington (AP)—Secretary of Air Donald Quarles, under pressure from Secretary of State Dulles, is reported to have put a ban on release of information about United States balloon operations.

Meanwhile the Soviets are saying, as they did Thursday, that the United States is using balloons to further a "brink of war" policy.

Defense and State Department officials are upset because they believe the United States was placed at a great disadvantage in the propaganda fight over this issue.

Mr. Quarles is reported to have received a phone call from Mr. Dulles early this week strongly objecting to balloon information Mr. Dulles believed came from Air Force sources.

Omaha World Herald 11 Feb 50

Incl 4

Reds Launch Balloon Blast

Moscow Holds Exhibit for Propaganda

Compiled from Press and Cable Dispatches.

The Soviet Union Thursday accused the United States of carrying out a "brink of war" policy in the release of weather balloons over Russian air space.

In a full-scale news conference at the Spiridonovka Palace in Moscow, Foreign Ministry Press Chief Leonid Ilyichev declared the balloons carried apparatus which not only took meteorological data but aerial reconnaissance as well.

He declared the balloons constituted a menace to air navigation and ground inhabitants and added:

"All such attempt by American military organs are an attempt to conduct a policy of 'to the brink of war' which has been condemned by peoples."

Now Grounded

The Soviet press chief was referring to a statement attributed to United States Secretary of State Dulles in a Life magazine article.

The United States, responding to Soviet protests, Wednesday ordered a halt to the launching of United States weather balloons from West Germany and Turkey. Balloons there will be grounded pending a study of whether they have been flying over Russia.

"These balloons were made in the United States," Mr. Ilyichev told correspondents. "Look at them if you care to."

By his side on the counter were pieces of apparatus, including a radio transmitter.

Obvious Fact

Mr. Ilyichev said the balloons were "launched by American military organs" from West Germany and "states neighboring the Soviet Union, for example Turkey."

The news conference was Moscow's biggest in recent months and it pointed up the obvious fact the Soviets wished to make all propaganda capital out of the apparatus.

The balloons were placed under the glare of Soviet newsreel and television cameras in the driveway of Spiridonovka Palace.

Molotov's Home

There were more than one hundred pieces of equipment on exhibit, said Richard K. O'Malley of the Associated Press.

Henry Shapiro of the United Press reported several dozen balloons floated about the palace courtyard.

The palace is the residence of Foreign Minister V. M. Molotov.

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TAB M
STATISTICS

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ERRATA

I. Except where otherwise indicated, the statistics discussed throughout this report were compiled as of 5 March 1956 with the major statistical tabulations being contained in the basic inclosures to this Tab. These statistics are sufficiently accurate to support a general analysis of the mission, however, where detailed and specific analysis is to be made, corrections to original compilations should be considered. These corrections are minor in nature and are contained in the three inclosures to this Errata sheet. The errata sheet inclosures are corrected reproductions of the applicable Study or Table contained in basic inclosures to this Tab. Where no change was required, the columns of the Errata inclosures contain the notation "No Change". Where changes are required, the entire column is reproduced and should be substituted in total for the like column in the basic inclosure. (U)

A. Balloon Launch Statistics:

1. Table Number 1 - Change due to addition of one successful launch for the 66CT type balloon and deletion of one successful launch for 128TT type balloons. (U)
2. Table Number 2 - Change due to addition of three successful launches for Detachment 1 and deletion of two successful launches for Detachment 4. (C)
3. Table Number 3 - Change due to addition of one successful launch for Detachment 5 and deletion of one successful launch for both Detachments 3 and 4. (C)

B. Balloon Serial Numbers:

1. Study Number 3 - Change due to addition of two unsuccessful 138TT type balloons and deletion of two unsuccessful 66CT type balloons. (U)

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BALLOON LAUNCH STATISTICS				128TT	TOTAL
66CT					
A. Launches					
1. No. Launches, attempted				105	516
2. No. Launches, successful				<u>74</u>	<u>399</u>
3. Percent successful				70.5	77.3
B.	*		*	*	*
C. Transmitted (HF Signal)					
1. No. which transmitted				33	123
2. Percent of successful launches				44.6	30.8
D. Arrived					
1. No. which reached recovery area				20	67
2. Percent of successful launches				27.0	16.8
3. Percent of those which transmitted				60.6	54.5
E. VHF Signal					
1. Functioned as planned				14	49
2. Percent of successful launches				18.9	12.3
3. Percent of those which transmitted				42.4	39.8
4. Percent of those which arrived				70.0	73.1
F. Termination Action					
*			*	*	*
Total				14	57
a. Percent of successful launches				18.9	14.3
b. Percent of those which transmitted				42.4	46.3
c. Percent of those which arrived				70.0	85.1

Errata Incl 1 (Table No. 1)

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		66CT Type Balloons				
		Det. 1	Det. 2	Det. 3	Det. 4	Det. 5 Total
A. Launches						
1. No. Launches, attempted		83			87	411
2. No. Launches, successful		<u>70</u>			<u>51</u>	<u>325</u>
3. Percent successful		84.3			58.6	79.1
B.		*			*	*
C. Transmitted (HF Signal)						
1. No. which transmitted		18	No Change		6	90
2. Percent of successful launches		25.7			11.8	27.7
D. Arrived						
1. No. which reached recovery area		5			1	47
2. Percent of successful launches		7.1			2.0	14.5
E. VHF Signal						
1. Functioned as planned		4			1	35
2. Percent of successful launches		5.7			2.0	10.8
3. Percent of those which transmitted		22.2			16.7	38.9
4. Percent of those which arrived		80.0			100.0	74.5
F. Termination Action						
Total		*			*	*
a. Percent of successful launches		5			1	43
b. Percent of those which transmitted		7.1			2.0	13.2
c. Percent of those which arrived		27.8			16.7	47.8
		100.0			100.0	91.5

Errata Incl 2 (Table No. 2)

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128TT Type Balloons						
		Det. 1	Det. 2	Det. 3	Det. 4	Det. 5
		Total				
A.	Launches					
	1. No. Launches, attempted		19	16	19	105
	2. No. Launches, successful		<u>14</u>	<u>9</u>	<u>10</u>	<u>74</u>
	3. Percent successful		73.7	56.3	52.6	70.5
B.		*	*	*	*	*
C.	Transmitted (HF Signal)					
	1. No. which transmitted		6	2	5	33
	2. Percent of successful launches		42.9	22.2	50.0	44.6
D.	Arrived					
	1. No. which reached recovery area		3	0	5	20
	2. Percent of successful launches		21.4	0	50.0	27.0
	3. Percent of those which transmitted		50.0	0	100.0	60.6
E.	VHF Signal					
	1. Functioned as planned		0	0	4	14
	2. Percent of successful launches		0	0	40.0	18.9
	3. Percent of those which transmitted		0	0	80.0	42.4
	4. Percent of those which arrived		0	0	80.0	70.0
F.	Termination Action	*	*	*	*	*
	Total					
	a. Percent of successful launches		0	0	4	14
	b. Percent of those which transmitted		0	0	40.0	18.9
	c. Percent of those which arrived		0	0	80.0	42.4
						70.0

Errata Inc: 3 (Table No. 3)

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Balloon Serial Numbers	(Showing Unsuccessful Flights)				Det. 5	Total	Failure Rate
	Det. 1	Det. 2	Det. 3	Det. 4			
			66CT Type Balloons				
0000-0099	10 (1)		0	2 (2)		33 (2)	6.1
0100-0199	0			7 (3)		26 (4)	15.4
0200-0299	4 (1)			20 (5)		24 (9)	37.5
0300-0399	7 (1)			0		35 (8)	22.9
0400-0499	15 (6)			34 (17)		27 (7)	25.9
0500-0599	0			18 (5)		43 (19)	44.2
0600-0699	0			0		80 (9)	11.3
0700-0799	21 (2)			5 (4)		69 (16)	23.2
0800-0899	26 (2)			1		31 (6)	19.4
0900-0999	0			0		12 (2)	16.7
1000-1099	0			0		29 (4)	13.8
1100-1199	0			0		1	0
Unknown	0			0		1	0
Total 66CT's	83 (13)			87 (36)		411 (86)	20.9
			128RT Type Balloons				
0000-0099			0	1 (1)		1 (1)	100.0
0500-0599			0	0		2 (2)	100.0
0600-0699			0	8 (6)		8 (6)	75.0
0800-0899			0	0		19 (8)	42.1
1100-1199			0	0		27 (4)	14.8
1300-1399			0	0		5 (2)	40.0
1400-1499			18 (5)	7		42 (8)	19.0
1500-1599			1	0		1	0
Total 128RT's			19 (5)	16 (7)		105 (31)	29.5
Grand Total	107 (19)		34 (7)	103 (43)		516 (117)	22.7
Failure Rate By Det.	18.6		20.6	41.7		-	-

Figure in parenthesis to right of column denotes number of known failures by series.

Errata Incl 1 (Study No. 3)

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I. STATISTICS

A. Balloon Launch Statistics:

1. A total of 516 Project 119L balloon launches were attempted. The break-out by type (66CT and 128TT) is shown in Table Number 1. This table shows, in percentages, the degree of success obtained during the phases of operations; i.e., Launch, Ascent, Transmitted, Arrived, Terminated and Recovered, as well as averages pertinent to each type balloon. (S)

2. A total of 411 balloon launches attempted were of the 66CT type balloon. The break-out by site is shown in Table Number 2. This table shows, in percentages, the degree of success obtained on the 66CT type balloon during the phases of operation, by site, the same items as listed in paragraph 1, above. (S)

3. A total of 105 balloon launches attempted were of the 128TT type balloon. The break-out by site is shown in Table Number 3. This table shows, in percentages, the degree of success obtained on the 128TT type balloon during the phases of operation, by site, the same items as listed in paragraph 1, above. (S)

4. The last known positions of terminated but unrecovered balloons are listed on Table Number 4. This table lists the Detachment Launch Number, Time of Termination, The Estimated Termination Positions, and the Forecast Positions of Downed Packages for 2 March 1956. (C)

B. Charts:

1. In addition to maps and various other means of presenting the daily information on the progress of accomplishments several charts were maintained for record keeping and briefing purposes. (U)

a. The master re-capitulation chart (Chart No. 1) reflects the primary items of interest and the break-out by total of balloons, and by type (66CT and/or 128TT) the total progress accomplished for each day of operations. (U)

b. Charts 2 thru 6 reflect the same information as listed in paragraph 1a, above. These charts show the individual accomplishments by site. (U)

c. An arrival chart (Chart No. 7) showing flight number, type of balloon, time of launch and time settings, how terminated, ground speeds, flight duration, and the recovery

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action for all flights which reached the recovery area, was maintained for quick appraisal of the overall success of the mission. (S)

d. The degree of success in accomplishments, in percentages, for given periods, by type of balloon (66CT and/or 128TT), for successful launches, effectiveness (those flights which were assumed to have penetrated the mission area), tracking, and arrivals were presented on Chart No. 8. The information by period is actually the accumulated total for each period given, (i.e. for the period 10-13 January 1956 the accumulated total was 29 for both types of balloons less launch failures.) (S)

e. Chart Number 9 portrays launches, successful ascents, number of balloons "fixed", and arrivals by day of launch. During the first 16 days ending 25 January 1956, 55% of the launches were made and these contributed over 90% of the arrivals. (S)

C. Hours Flying Time:

1. The flying hour allocation for the 456th Troop Carrier Wing was based on an aircraft in-commission rate of 75% with an average flying hour consumption of 3 hours per day per aircraft for mission operations. (U)

2. A total of 7,312 hours were utilized during the period 11 December 1955 to 25 February 1956. This resulted in a utilization rate of 1.9 hours per aircraft per day during this period of operations. (U)

3. Table Number 5 shows the total flying hour utilization, by Wing and by Squadron, for the three periods - Preparation - Deployment - Operations. The average number of possessed aircraft, and the average hour utilization for each of these periods. (U)

D. Aircraft In-commission Rates:

1. For this report the aircraft in-commission rates were computed for three periods, these were:

a. Preparation - 9 May 1955 to 12 November 1955
(Table Number 6). (U)

b. Deployment - 13 November 1955 to 10 December 1955
(Table Number 7). (U)

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c. Operations - 11 December 1955 to 25 February 1956
(Table Number 8). (U)

2. The aircraft in-commission goal for this mission was 80 percent. With the exception of the "Preparation Period", even though some of the ACCP Rates were high due to the high priority of this mission, this goal was achieved both during deployment and operations periods. (U)

E. Studies:

1. Aircraft Engine (R-3350-39 and 39A).

a. A study of this type engine, used on the C-119F aircraft of the 456th Troop Carrier Wing, revealed that the modified 39A was not performing as well as the 39, consequently the change from the 39 to the 39A was curtailed during December 1955. The 39 has an engineering designed life expectancy of 600 hours as compared to 700 hours for the 39A; however, these life expectancy rates are based on normal cruising altitudes of the aircraft utilizing these type engines. Prior to the departure of the 456th Troop Carrier Wing, the 13th Air Force experienced a "Time Before Overhaul" of 365 hours for the R-3350-39 type engine. (U)

b. During the period August 1955 thru January 1956 the 456th Troop Carrier Wing had experienced a total of 96 engine removals (82 - 39's and 14 - 39A's) for major overhaul. This Wing has 50 C-119F aircraft. (U)

c. Study Number 1 compares the engine removal rates (for major overhaul) of the 39 and 39A. (U)

2. Ground Speed Sampling.

a. Study Number 2 compares the ground speed for L201T type balloons launched from 3 of the launch sites.

b. The flights from ONE and CIE averaged 53 and 54 miles per hour and arrived in 4 1/2 days, while the flights from ADL, which enjoyed stronger wind streams, averaged 73 miles per hour.

3. Balloon Serial Numbers.

a. The balloon serial numbers were broken out by 100's (for type balloons). The number flown within each 100

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series was then computed against the known failures (failures occurring during launch and ascent) for a failure rate (Study Number 3), and then against the known successful flights (flights which terminated in the recovery area) for a successful rate (Study Number 4). (C)

b. These studies were made in an attempt to pinpoint a series of balloons which may have been a defectively manufactured group. (U)

c. In the 66CT type balloons the group numbering between 300 and 599 had a relatively high failure rate as well as a low successful rate. (U)

d. In the 123TT type balloons the group numbering below 900 had a failure rate of 53%. During the later part of operations the launching of 123TT's numbering below 950 was discontinued. (C)

e. The original shipment of balloons (of the 123TT type) to Detachment Number 5 was primarily of the low numbered balloons; however, due to the location of this Detachment 40 of these low numbered balloons were shipped to Detachment Number 4 for experimental purposes and a further study of the cause of failures in this group. (C)

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JANUARY 1956																	
DATE	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
66CT LAUNCHED 128TT	2	12	10	3	8	3	3	4	16	9	15	18	17	19	22	22	
	9	13	13	12	11	10	11	25	22	23	21	21	17	23	22		
	7	1	3	9	3	7	8	21	6	14	6	3	4	4	22		
FAILED	1	7	3	1	1	1	3		3		5	5	2	2	3	3	
	1	7	6	4	2	1	3	7	4	4	7	6	2	4	2		
			3	3	1	1	3	7	1	4	2	1			2		
SUCCESS	2	5	7	2	7	3	3	4	13	9	10	13	15	17	19	19	
	8	6	7	8	9	9	8	18	18	19	14	15	15	19	19		
	6	1	7	6	2	6	5	14	5	10	4	2	2	2	2		
EFFECTIVE	2	5	7	2	7	3	3	4	12	9	10	12	13	16	19	19	
	7	6	7	8	9	9	8	18	17	18	14	14	13	18	18		
	5	1		6	2	6	5	14	5	9	4	2		2	2		
TRACKED	2	4	7		3		1	2	8	4	1	8	6	2	4	4	
	7	4	7	4	4	4	2	6	12	11	2	8	6	2	2		
	5			4	1	4	1	4	4	7	1						
ARRIVED	2	2	1		1	1		2	4	3	1	9	7	2	5	5	
	6	2	1	3	2	1		2	7	8	2	9	7	2			
	4			3	1	1			3	5	1						
TERM.	2	2	1						4	3	1	8	6	2	4	4	
	6	2	1	2				1	6	7	2	8	6	2			
	4			2				1	2	4	1						
RECOVERED	1	1	1						4	1	1	6	5	1	4	4	
	5	1	1	2				1	4	5	2	6	5	1			
	4			2				1	4	4	1						
MASTER RECAP																	

MASTER RECAP

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Chart No. 1

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		FEBRUARY 1956												TOTAL	
		JANUARY 1956													
DATE		25	26	27	28	29	30	31	1	2	3	4	5	6	
66GT	31	28	28	22	31	38	19	18	2	14	17	8	13	9	411
LAUNCHED	31	28	28	22	32	38	19	18	2	14	19	11	13	16	516
128TT					1						2	3		7	105
FAILED	8	5	5	11	9	6	3	1		4	1	5	1	1	86
	8	5	5	11	10	6	3	1		4	1	5	1	1	31
SUCCESS	23	23	23	11	22	32	16	17	2	10	16	3	12	9	325
	23	23	23	11	22	32	16	17	2	10	18	6	12	15	74
EFFECTIVE	23	23	23	11	21	31	16	17	2	9	16	3	12	8	316
	23	23	23	11	21	31	16	17	2	9	18	5	12	14	387
TRACKED	12	4	4	1	2	7	2	4		1	5			2	90
	12	4	4	1	2	7	2	4		1	5			2	123
ARRIVED	5							1							47
	5							1			4	4			67
TERMINATED	5							1							20
	5							1			4	4			43
RECOVERED	5							1							57
	5							1							14
															32
											2				44
											2				12

MASTER RECAP KNOWN STRAYS-12 EXPIRED-330

As of 5 Mar 56

Chart No. 1 Cont'd

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		JANUARY																					FEBRUARY						
DATE	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	TOTAL
66CT LAUNCHED 128TT		6	5	3		1	2	4	4	3	8	4	3	3		8	11	10	10	12	8	5	2	2	2				83 107 24
FAILED		2	1	1					3	4	1	1	3	1		1	1		2	2									13 19 6
SUCCESS		4	4	2		1	2	4	1	3	6	5	2	3	2	7	10	10	10	6	5	2	2	2	2				70 88 18
EFFECTIVE		4	4	2		1	2	4		3	6	5	2	3	2	7	10	10	10	6	5	2	2	2	2				69 87 18
TRACKED		3	3	2			1	1	1	1	2	1				4	1	1	3				1	1					18 23 5
ARRIVED		2	2	1						1	1					2	2												5 7 2
TERM.		2	1	1						1	1					2	2												5 7 2
RECOVERED		1	1	1						1	1					2	2												4 6 2

KNOWN STRAYS 1 EXPIRED 80

DETACHMENT #1 OBERPFAFFENHOFEN

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FEBRUARY																														
DATE	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	TOTAL	
66CT LAUNCHED 128TT	1	1	2		4	2	1		7	3	5	10	10	7	13	1	10		5	10	5	12			2	7		13	7	138
	8	1	2		4	5	1	5	11	7	6	10	10	7	13	1	10		5	10	5	12		2	7		13	10	165	
	7				3			5	4	4	1														7			3	27	
FAILED		1									4				1		2							1			1			10
	1	1						2		1	4				1		2							1			1			14
	1							2		1																				4
SUCCESS	1		2		4	2	1		7	3	1	10	10	7	12	1	8		5	10	5	12			1	7		12	7	128
	7	6			4	5	1	3	11	6	2	10	10	7	12	1	8		5	10	5	12		1	7		12	0	151	
	6					3		3	4	3	1																3	23		
EFFECTIVE	1		2		4	2	1		7	3	1	10	10	6	12	1	8		5	9	5	12			1	7		12	7	124
	6	5			4	5	1	3	11	5	2	10	8	6	12	1	8		5	9	5	12		1	7		12	10	145	
	5					3		3	4	2	1																3	21		
TRACKED	1		2		1				5	3	1	8	6	2	4				1	1		4			1					39
	6		2		1	3		1	8	5	2	8	6	2	4				1	1		4			1					54
	5					3		1	3	2	1																		15	
ARRIVED	1								4	3	1	9	7	2	5	1					1				1					35
	5								7	5	2	9	7	2	5	1					1				1					45
	4								3	2	1																		10	
TERM.	1								4	3	1	8	6	2	4	1					1				1					32
	5								6	4	2	8	6	2	4	1					1				1					40
	4								2	1	1																		8	
RECOVERED									4	2	1	6	5	1	4	1									1					25
	4								4	2	1	6	5	1	4	1									1					30
	4										1																		5	

KNOWN STRAYS 6 EXPIRED 105

DETACHMENT #2 ADANA

As of 5 March 56

Chart No. 3

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DATE	JANUARY															FEBRUARY						TOTAL									
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		31	1	2	3	4	5	6		
66GT LAUNCHED 128TT				3	4	5	3	6	4	3														1	1				4	4	15 34 19
FAILED				1	1	1	1	3																					1	1	2 7 5
SUCCESS				2	3	4	2	3	4	3														1	1				3	3	13 27 14
EFFECTIVE				2	3	4	2	3	4	3														1	1				3	3	13 27 14
TRACKED					2		3	1	3	4																			2	2	7 13 6
ALIVED					1	2	1	1																							1 4 3
TERMINATED																															
RECOVERED																															

Chart No. 4

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TOP SECRET

KNOWN STRAYS 0 EXPIRED 27

DETACHMENT #3 GARDERMOEN

As of 5 March 56

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TOP SECRET

Chart No. 5

JANUARY												FEBRUARY												TOTAL						
DATE	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	TOTAL	
66GT LAUNCHED 128TT												8	4	8	9	13		15	5	5				12	8				87	
		1	3	2	2					2		8	4	8	9	13		15	6	5				12	2	11			103	
		1	3	2	2					2		8	4	8	9	13		15	1	5				2	2	3			16	
FAILED												5	2	1	2	5		11	2					3	5				36	
			3	2	1							5	2	1	2	5		11	3					3	5				43	
			3	2	1							5	2	1	2	5		11	1										7	
SUCCESS												3	2	7	7	8		4	3	5				9	3				51	
		1			1					2		3	2	7	7	8		4	3	5				9	2	6			60	
		1			1					2		3	2	7	7	8		4	3	5				9	2	3			9	
EFFECTIVE												2	2	7	7	8		4	3	5				8	3				49	
		1			1					2		2	2	7	7	8		4	3	5				8	2	5			57	
		1			1					2		2	2	7	7	8		4	3	5				8	2	2			8	
TRACKED																			1					1					6	
																			1					1					8	
										2									1					1					2	
ARRIVED										2																			1	
																													1	
TERMINATED																													1	
																													1	
RECOVERED																													1	
																													1	

As of 5 March 56

DETACHMENT #4 EVANTON

KNOWN STRAYS 3 EXPIRED 56

TOP SECRET

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TOP SECRET

JANUARY																															FEBRUARY						TOTAL
DATE	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6									
66CT LAUNCHED 128TT	1	5	3	4		1	2		2	3	6			4	9	7	7	7	11	11	6	1			7			2	88								
	1	5	3	4	1	1	2	8	2	8	7			5	9	7	7	7	11	11	6	1			7			2	107								
FAILED		4	2					8		5	1			1	2	2	2		7	4	1	1			1				25								
		4	2					5		3				1	2	2	2		7	4	1	1			1				34								
SUCCESS	1	1	1	4		1	2		2	3	6			3	7	5	7	7	4	7	5				6			2	63								
	1	1	1	4	1	1	2	3	2	5	7			3	7	5	7	7	4	7	5				6			2	73								
EFFECTIVE	1	1	1	4		1	2		2	3	6			3	7	5	7	7	3	7	5				6			1	61								
	1	1	1	4	1	1	2	3	2	5	7			3	7	5	7	7	3	7	5				6			1	71								
TRACKED	1	1	1	2						2	1					4	3	1		3	2								20								
	1	1	1	2		1	1	1		2					4	3	1	1	3	3	2				3				25								
ARRIVED	1			2						2					1														5								
	1			2						2					1														5								
TERM.	1			1						2					1														5								
	1			1						2					1														10								
RECOVERED	1			1						2					1														5								
	1			1						2					1														9								
	1			1						2					1														4								
	1			1						2					1														4								
	1			1						2					1														3								
	1			1						2					1														7								
																													4								

as of 5 March 56

DETACHMENT #5 GIEBELSTADT

KNOWN STRAYS 2 EXPIRED 62

KNOWN STRAYS 2 EXPIRED 62

DETACHMENT #5 GIEBELSTADT

OPAs of 5 March 56

TOP SECRET



TOP SECRET

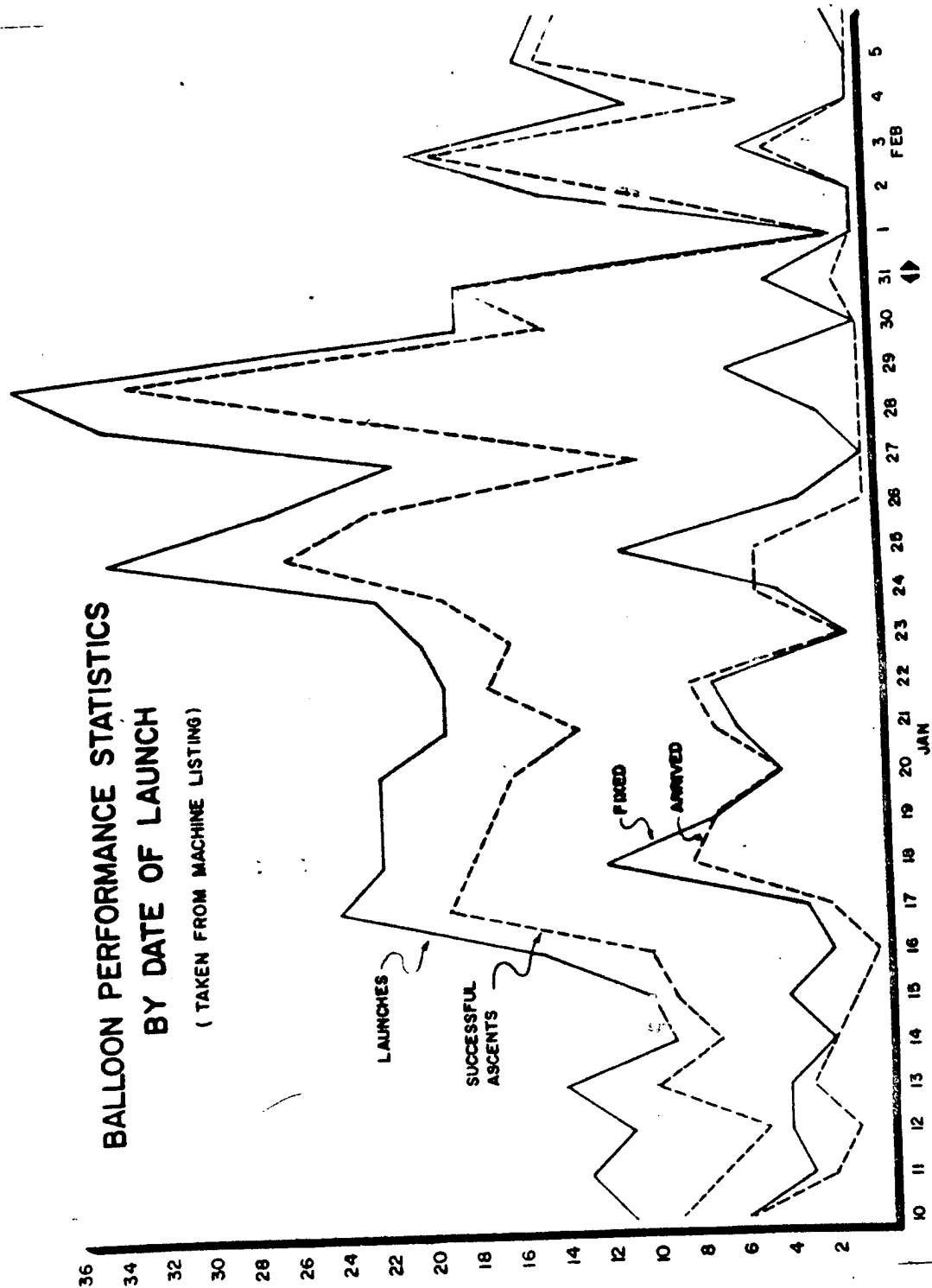


Chart No. 9

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(Format for 8x10 1/2 paper.)

TOP SECRET

TOP SECRET

BALLOON LAUNCH STATISTICS

Table No. 1

	66CT	128TT	TOTAL
A. Launches			
1. No. launches, attempted	411	105	516
2. No. launches, successful	324	75	399
3. Percent successful	<u>78.8</u>	<u>71.4</u>	<u>77.3</u>
B. Averages			
1. Average Gross Weight (lbs)	1622 (173)	2332 (83)	--
2. Average Ballast Weight (lbs)	580 (67)	973 (30)	--
3. Average Percent of Free Lift (%)	9.1 (404)	7.0 (105)	--
4. Average Surface Winds (knots)	6.2 (156)	6.1 (67)	--
5. Average Maximum Ascent Rate (FPM)	1540.0 (121)	1430.0 (51)	--
Remark: Figure in parenthesis to right of columns is the number on which averages were computed.			
C. Transmitted (HF Signal)			
1. No. which transmitted	90	33	123
2. Percent of successful launches	27.8	44.0	30.8
D. Arrived			
1. No. which reached recovery area	47	20	67
2. Percent of successful launches	14.5	26.7	16.8
3. Percent of those which transmitted	52.2	60.6	54.5

TOP SECRET

TOP SECRET

	66CT	128FT	TOTAL
E. VHF Signal			
1. Functioned as Planned	35	14	49
2. Percent of successful launches	10.8	18.7	12.3
3. Percent of those which transmitted	38.9	42.4	39.8
4. Percent of those which arrived	74.5	70.0	73.1
F. Termination Action			
1. Air cut-down, successful	21	13	34
2. Ground cut-down, successful	13	1	14
3. Other friendly action	1	0	1
4. Self-termination, terminal signal heard	1	0	1
5. Self-termination, no terminal signal heard	7	0	7
Total	43	14	57
a. Percent of successful launches	13.3	18.7	14.3
b. Percent of those which transmitted	47.8	42.4	46.3
c. Percent of those which arrived	91.5	70.0	85.1
G. Air Recovery Action (Recovery attempts)			
1. Air-to-air only, successful	10	6	16
2. Air-to-air, cut-down failed	2	0	2
3. Air-to-air, Drogue chute failed	2	0	2
4. Air-to-air, Drogue chute tore	1	0	1
5. Air-to-air, missed	1	0	1
6. No air recovery attempted	26	8	34
H. Flight Duration			
1. No. of flights	34	14	48
2. Average (known) flight duration (hours)	82.4	91.0	--

Table No. 1 Cont'd

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TOP SECRET

TOP SECRET

	660T	1280T	TOTAL
I. Ground Speed (From launch to termination)			
1. No. of flights	38	15	53
2. Average (known) speed (knots)	68.4	60.7	--
J. Ground Speed (From 1st fix to termination)			
1. No. flights	39	15	54
2. Average (known) speed (knots)	91.6	72.0	--
K. Camera Results			
1. Camera worked	20	5	25
2. Camera worked partially	9	6	15
3. Camera failed	3	1	4
Total	32	12	44
L. Time of Launches			
1. Dark	264	49	313
2. Morning twilight	7	2	9
3. Day	131	53	184
4. Evening twilight	9	1	10
Total	411	105	516
M. Type Equipment			
1. Gondola (DMQ-1)	411	105	516

Table No. 1 Cont'd

TOP SECRET

TOP SECRET

M. Type Equipment Cont'd		66CT	128TT	TOTAL
2.	*Camera	17	19	36
	a. Bill Jack	87	16	103
	b. Chicago Aerial	136	27	163
	c. Eastman	83	24	107
	d. Fairchild	88	19	107
e. Hycon				
*Primary Type at Sites.				

Table No. 1 Cont'd

TOP SECRET

TOP SECRET

66CT Type Balloons

Table No. 2

A. Launches	66CT Type Balloons				
	Det. 1	Det. 2	Det. 3	Det. 4	Det. 5
1. No. Launches, attempted	83	138	15	87	88
2. No. Launches, successful	<u>67</u>	<u>128</u>	<u>13</u>	<u>53</u>	<u>63</u>
3. Percent successful	80.7	92.8	86.7	60.9	71.6
					78.8
					411
					324
					78.8
B. Averages					
1. Average Gross Weight (lbs)	1610 (49)	1613 (19)	1610 (14)	1652(31)	1622(60)
2. Average Ballast Weight (lbs)	564 (16)	552 (11)	-	606(22)	579(18)
3. Average Percent of Free Lift (%)	8.4 (81)	9.2(133)	7.0 (15)	10.6(87)	8.6(88)
4. Average Surface Winds (Knots)	7.2 (49)	8.6 (17)	6.4 (12)	2.9(27)	6.2(51)
5. Average Maximum Ascent Rate (FPM in 10's)	141 (48)	155 (2)	143 (3)	172(11)	162(57)
					154(121)

Remark: Figure in parenthesis to right of columns is the number on which averages were computed.

C. Transmitted (HF Signal)					
1. No. which transmitted	18	39	7	6	20
2. Percent of successful launches	26.9	30.5	53.8	11.3	31.7
					27.8

TOP SECRET

TOP SECRET

6607 Type Balloons Cont'd		Det.1	Det.2	Det.3	Det.4	Det.5	Total
D. Arrived							
1. No. which reached recovery area		5	35	1	1	5	47
2. Percent of successful launches		7.5	27.3	7.7	1.9	7.9	14.5
3. Percent of those which transmitted		27.8	89.7	14.3	16.7	25.0	52.2
E. VHF Signal							
1. Functioned as planned		4	27	0	1	3	35
2. Percent of successful launches		6.0	21.1	0	1.9	4.8	10.8
3. Percent of those which transmitted		22.2	69.2	0	16.7	15.0	38.9
4. Percent of those which arrived		80.0	77.1	0	100.0	60.0	74.5
F. Termination Action							
1. Air cut-down, successful	3	15	0	0	0	3	21
2. Ground cut-down, successful	0	13	0	0	0	0	13
3. Other Friendly action	1	0	0	0	0	0	1
4. Self Termination Signal Heard	0	0	0	0	0	1	1
5. Self Termination, No Terminal Signal Heard	$\frac{1}{5}$	$\frac{4}{32}$	$\frac{0}{0}$	$\frac{1}{1}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{7}{43}$
Total							
a. Percent of successful launches	7.5	25.0	0	1.9	7.9		13.3
b. Percent of those which transmitted	27.8	80.1	0	16.7	25.0		47.8
c. Percent of those which arrived	100.0	91.4	0	100.0	100.0		91.5

Table No. 2 Cont'd

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TOP SECRET

66CT Type Balloons Cont'd	Det.1	Det.2	Det.3	Det.4	Det.5	Total
G. Air Recovery Action (Recovery Attempts)						
1. Air-to-Air only, successful	3	5	0	1	1	10
2. Air-to-Air, cut-down failed	1	0	0	0	1	2
3. Air-to-Air, Drogue chute failed	0	2	0	0	0	2
4. Air-to-Air, Drogue chute tore	0	0	0	0	1	1
5. Air-to-Air, missed	0	0	0	0	1	1
6. No Air Recovery attempted	1	24	0	0	1	26
H. Flight Duration						
1. No. of Flights	5	24	0	1	4	34
2. Average (known) flight duration (Hours)	126.0	60.6	0	168.0	137.8	82.4
I. Ground Speed (From launch to termination)						
1. No. of Flights	5	26	1	1	5	38
2. Average (known) speed (knots)	48.0	80.0	20.0	30.0	42.0	68.4
J. Ground Speed (From 1st fix to termination)						
1. No. of Flights	5	27	1	1	5	39
2. Average (known) speed (knots)	54.0	113.0	20.0	30.0	40.0	91.6

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66GT Type Balloons Cont'd		Det.1	Det.2	Det.3	Det.4	Det.5	Total
K. Camera Results							
1. Camera Worked		2	15	0	0	3	20
2. Camera Worked Partially		1	7	0	1	0	9
3. Camera Failed		1	2	0	0	0	3
Total		4	24	0	1	3	32
L. Time of Launches							
1. Dark		83	64	4	27	86	264
2. Morning twilight		0	1	0	6	0	7
3. Day		0	69	10	51	1	131
4. Evening twilight		0	4	1	1	1	9
Total		83	138	15	87	88	411
M. Type Equipment							
1. Gondola (DMQ-1)		83	138	15	87	88	411
2. *Camera		-	2	15	-	-	17
a. Bill Jack		-	-	-	87	-	87
b. Chicago Aerial		-	136	-	-	-	136
c. Eastman		-	-	-	-	-	83
d. Fairchild		83	-	-	-	-	83
e. Hycon		-	-	-	-	88	88

*Primary Type as Site.

TOP SECRET

TOP SECRET

128TT TYPE BALLOONS

Table No. 3

A. Launches

	Det.1	Det.2	Det.3	Det.4	Det.5	Total
1. No. Launches, Attempted	24	27	19	16	19	105
2. No. Launches, Successful	<u>18</u>	<u>23</u>	<u>15</u>	<u>10</u>	<u>9</u>	<u>75</u>
3. Percent Successful	75.0	81.2	78.9	62.5	47.4	71.4

B. Averages

1. Average Gross Weight (lbs)	2330 (24)	2344 (12)	2330 (17)	2330 (11)	2329 (19)	2332 (83)
2. Average Ballast Weight (lbs)	970 (5)	993 (9)	977 (3)	955 (4)	960 (9)	973 (30)
3. Average Percent of Free Lift (%)	6.5 (24)	7.0 (27)	7.0 (19)	8.1 (16)	6.8 (19)	7.0 (105)
4. Average Surface Winds (knots)	6.2 (21)	9.0 (6)	4.5 (15)	4.6 (10)	7.4 (15)	6.1 (67)
5. Average Maximum Ascent Rate (FPM in 10's)	134 (23)	-	128 (4)	138 (6)	160 (18)	143 (51)

Remark: Figure in parenthesis to right of columns is the number on which averages were computed.

C. Transmitted (HF Signal)

1. No. which transmitted	5	15	6	2	5	33
2. Percent of successful launches	27.8	65.2	40.0	20.0	55.6	44.0

D. Arrived

1. No. Which Reached Recovery Area	2	10	3	0	5	20
2. Percent of successful launches	11.1	43.5	20.0	0	55.6	26.7
3. Percent of those which transmitted	40.0	66.7	50.0	0	100.0	60.6

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128FT Type Balloons Cont'd		Det.1	Det.2	Det.3	Det.4	De.5	Total
E. VHF Signal							
1. Functioned as planned		2	8	0	0	4	14
2. Percent of successful launches		11.1	34.8	0	0	44.4	18.7
3. Percent of those which transmitted		40.0	53.3	0	0	80.0	42.4
4. Percent of those which arrived		100.0	80.0	0	0	80.0	70.0
F. Termination Action							
1. Air cut-down, successful		2	7	0	0	4	13
2. Ground cut-down, successful		0	1	0	0	0	1
3. Self termination, no terminal signal heard		0	0	0	0	0	0
Total		2	8	0	0	4	14
a. Percent of successful launches		11.1	34.8	0	0	44.4	18.7
b. Percent of those which transmitted		40.0	53.3	0	0	80.0	42.4
c. Percent of those which arrived		100.0	80.0	0	0	80.0	70.0
G. Air Recovery Action (Recovery Attempts)							
1. Air-to-Air only, successful		1	4	0	0	1	6
2. No air recovery attempted		1	4	0	0	3	8

Table No. 3 Cont'd

TOP SECRET

TOP SECRET

Table No. 3 Cont'd

128TT Type Balloons Cont'd	Det.1	Det.2	Det.3	Det.4	Det.5	Total
H. Flight Duration						
1. No. of Flights	2	8	0	0	4	14
2. Average (Known) Flight Duration (Hours)	102.0	64.8	0	0	137.8	91.0
I. Ground Speed (From launch to termination)						
1. No. of Flights	2	8	0	0	5	15
2. Average (known) speed (knots)	55.0	73.8	0	0	42.0	60.7
J. Ground Speed (From 1st fix to termination)						
1. No. of Flights	2	8	0	0	5	15
2. Average (known) speed (knots)	60.0	95.0	0	0	40.0	72.0
K. Camera Results						
1. Camera Worked	0	2	0	0	3	5
2. Camera Worked Partially	1	4	0	0	1	6
3. Camera Failed	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total	2	6	0	0	4	12
L. Time of Launches						
1. Dark	12	17	3	7	10	49
2. Morning Twilight	1	0	0	1	0	2
3. Day	11	10	15	8	9	53
4. Evening Twilight	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total	24	27	19	16	19	105

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TOP SECRET

	Det.1	Det.2	Det.3	Det.4	Det.5	Total
105	24	27	19	16	19	105
19	-	-	19	-	-	19
16	-	-	-	16	-	16
27	-	27	-	-	-	27
24	24	-	-	-	-	24
19	-	-	-	-	19	19

M. 128TT Type Balloons Cont'd

M. Type Equipment

1. Gondola (DMQ-1)

2. *Camera

a. Bill Jack

b. Chicago Aerial

c. Eastman

d. Fairchild

e. Hycon

*Primary Type at Site

Table No. 3 Cont'd

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Last Known Positions of Terminated But Unrecovered Balloons

<u>Package</u>	<u>Term</u>	<u>Estimated Termination Position</u>	<u>Forecast Positions of Downed Packages for 2 Mar</u>
OBE 1	16 Jan	100 miles at sea, East Honshu	32.6N 151.2E
ADA 5	13 Jan	75 miles at sea, East Honshu	32.3N 150.5E
ADA 33	21 Jan	125 miles at sea, East Honshu	35.9N 151.5E
ADA 37	21 Jan	100 miles at sea, East Honshu	33.1N 149.4E
ADA 38	21 Jan	MTS North Central Honshu	Mountains - North 150.5E Central Honshu
ADA 39	21 Jan	Land or sea east coast of Honshu	If in sea 33.3N 150.3E
ADA 51	23 Jan	MTS on Honshu	Mountains on Honshu
ADA 59	23 Jan	Sea 50 miles at Tokyo Bay	Possible located at 34.20N 139.14E If not, then 32.3N 147.4E
ADA 65	24 Jan	MTS of Kyushu	Mountains of Kyushu
ADA 71	25 Jan	200 miles at sea, East of Honshu	34.3N 153.4E
ADA 122	4 Feb	At sea West Hokkaido	Probably on land at 41.32N 140.04E or west coast Hokkaido possible at 38.2N 141.6E or if flight terminated 150 miles west Hokkaido then package caught in cyclonic currents in Sea of Japan possibly at 41.3N 137.9E
GIE 100	8 Feb	37.5N 132.5E Sea of Japan	36.9N 134.0E

Table No. 4

TOP SECRET

TOP SECRET

<u>Package</u>	<u>Term</u>	<u>Estimated Termination Position</u>	<u>Forecast Positions of Downed Packages for 2 Mar</u>
GIE 105	8 Feb	MTS 100 miles south Misawa	Mountains 100 miles South Misawa

Table Number 4 Cont'd

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Period	HOURS FLYING TIME						
	Wing Total	744Th	744-Det 1	745Th	745-Det 1	746Th	746-Det 1
Preparation 9 May-12 Nov 55	14,901:45	2,694:05	2,149:10	2,363:50	2,671:05	2,479:10	2,544:25
1. Avg No. Aircraft	42.9	7.3	7.0	7.2	6.8	6.9	7.7
2. Avg Hours per Aircraft	347:22	369:03	307:01	328:19	392:49	359:18	330:26
Deployment 13 Nov-10 Dec 55	2,409:10	516:10	519:25	214:20	217:35	191:15	750:25
1. Avg No. Aircraft	49.8	8.0	7.8	8.0	8.0	8.0	10.0
2. Avg Hours per Aircraft	48:23	64:31	66:35	26:47	27:12	23:55	75:02
Operations 11 Dec 55-25 Feb 56	7,312:50	1,296:10	1,286:05	774:55	1,279:55	1,162:10	1,513:35
1. Avg No. Aircraft	50.0	8.0	8.0	7.4	8.0	7.4	11.2
2. Avg Hours per Aircraft	146:16	162:01	160:46	104:43	159:59	157:03	135:08

Table No. 5

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456TH TROOP CARRIER WING

Aircraft In-Commission Rates

Preparation: 9 May - 12 Nov 1955

	Hours O/H	Hours in Commission	Hours AACP	Hours ACOM	Average Aircraft O/H	Percent in Commission	ercent AACP	Percent ACOM
744	32,854	20,622	3,810	9,422	7.3	62.8	11.6	25.6
744-1	31,529	17,804	5,451	8,274	7.0	56.5	17.3	26.2
745	32,709	16,830	5,519	10,360	7.2	51.5	16.9	31.6
745-1	30,880	18,397	3,722	8,761	6.8	59.6	12.1	28.3
746	30,931	19,822	3,153	7,956	6.9	64.1	10.2	25.7
746-1	34,763	23,760	5,135	5,868	7.7	68.3	14.8	16.9
WING	193,666	117,235	26,790	49,641	42.9	60.5	13.8	25.7
TOTALS								

Table No. 6 227

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TOP SECRET

456TH TROOP CARRIER WING

Aircraft In-Commission Rates

Deployment 13 Nov-10 Dec 55

Wing No.	Hours O/H	Hours in Commission	Hours AOCF	Hours AOCM	Average Aircraft O/H	Percent in-Commission	Percent AOCF	Percent AOCM
744	5,376	4,728	-	648	8.0	87.9	0	12.1
744-1	5,256	4,367	39	850	7.8	83.1	0.7	16.2
745	5,376	3,552	203	1,621	8.0	66.1	3.7	30.2
745-1	5,376	4,828	166	382	8.0	89.8	3.1	7.1
746	5,376	4,016	551	809	8.0	74.7	10.2	15.1
746-1	6,720	5,909	96	715	10.0	87.9	1.4	10.7
Wing Total	33,480	27,400	1,055	5,025	49.8	81.8	3.2	15.0

Table No. 7

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456TH TROOP CARRIER WING

Aircraft In-Commission Rates

Operations: 11 Dec 55 - 25 Feb 56

	Hours O/H	Hours in Commission	Hours AOCF	Hours AOCM	Average Aircraft O/H	Percent in Commission	Percent AOCF	Percent AOCM
744	14,784	12,555	557	1,672	8	84.9	3.8	11.3
744-1	14,784	11,998	642	2,144	8	81.1	4.3	14.6
745	13,632	10,064	2,287	1,281	7.4	73.8	16.8	9.4
745-1	14,784	10,493	2,542	1,749	8	71.0	17.2	11.8
746	13,632	11,651	1,229	752	7.4	85.5	9.0	5.5
746-1	<u>20,784</u>	<u>17,403</u>	<u>1,877</u>	<u>1,504</u>	<u>11.2</u>	<u>83.7</u>	<u>9.0</u>	<u>7.3</u>
WING TOTAL	92,400	74,164	9,134	9,102	50	80.3	9.9	9.8

Table No. 8

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Aircraft Engines

(R-3350-39 and 39A's)

<u>Hours on Engine Prior to Removal</u>	<u>39's</u>	<u>39A's</u>
0 - 50	3.6%	14.3%
- - -		
101 - 150	15.3%	64.3%
151 - 200	21.9%	78.6%
- - -		
251 - 300	30.4%	93.8%
- - -		
351 - 400	54.9%	-
401 - 450	82.9%	-
- - -		
501 - 550	100.0%	100.0%

Study Number 1

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GROUND SPEED SAMPLING

1. A comparison of 128TT system profiles with the increasing Hazel photo indices reveals the following information:

15 Jan OBE 14 flew 5 hours at 51,000 feet averaging 29 MPH
16 Jan OBE 14 flew 6 hours at 52,000 feet averaging 31 MPH
17 Jan OBE 14 flew 5 hours at 54,000 feet averaging 55 MPH
22 Jan OBE 32 flew $2\frac{1}{2}$ hours at 57,000 feet averaging 68 MPH
23 Jan OBE 32 flew $3\frac{1}{2}$ hours at 59,000 feet averaging 42 MPH
18 Jan GIE 23 flew 1 hour at 51,000 feet averaging 88 MPH
12 Jan ADA 3 flew $5\frac{1}{2}$ hours at 52,000 feet averaging 68 MPH
13 Jan ADA 3 flew $1\frac{1}{2}$ hours at 54,000 feet averaging 109 MPH
13 Jan ADA 4 flew 1 hour at 51,000 feet averaging 105 MPH
11 Jan ADA 7 flew 1 hour at 52,000 feet averaging 90 MPH
12 Jan ADA 7 flew 4 hours at 54,000 feet averaging $44\frac{1}{2}$ MPH (C)

2. It should be pointed out that where speeds shown above approach 100 miles per hour, balloons were either approaching or were physically in the recovery area. Where the speeds were of lesser value, they were at various positions over the Union of Soviet Socialist Republics or satellite countries. (TS)

3. Referring to our records on all 128TT balloon flights which successfully traversed the area of interest, we arrive at a more realistic picture of what might be expected when only 128TT's are launched; i.e., flights from OBE and GIE averaged 53 and 54 miles per hour and arrived in $4\frac{1}{4}$ days. 128TT flights from ADA enjoyed stronger wind streams and averaged 73 miles per hour and entered the recovery zone after a 2 day, 16 hour average flight time. (S)

Study Number 2

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Balloon Serial Numbers	Unsuccessful Flights					Total	Failure Rate
	Det 1	Det 2	Det 3	Det 4	Det 5		
66CT Type Balloons							
0000-0099	10 (2)	22 (1)	0	0	1	33 (3)	9.1
0100-0199	0	23 (2)	1	2 (2)	0	26 (4)	15.4
0200-0299	4 (1)	1 (1)	3	7 (2)	9 (4)	24 (8)	33.3
0300-0399	7 (1)	0	0	20 (5)	8 (2)	35 (8)	22.9
0400-0499	15 (6)	1	3	0	8 (1)	27 (7)	25.9
0500-0599	0	1	8 (2)	34 (16)	0	43 (18)	41.9
0600-0699	0	55 (1)	0	18 (5)	7 (3)	80 (9)	11.2
0700-0799	21 (4)	1	0	0	47 (14)	69 (18)	26.1
0800-0899	26 (3)	0	0	5 (4)	0	31 (7)	22.6
0900-0999	0	11 (2)	0	1	0	12 (2)	16.7
1000-1099	0	22 (3)	0	0	7 (1)	29 (4)	13.8
1100-1199	0	0	0	0	1	1	0
Unknown	0	1	0	0	0	1	0
Total 66CT's	83 (17)	138 (10)	15 (2)	87 (34)	88 (25)	411 (88)	21.4
128TR Type Balloons							
0000-0099	0	0	0	1 (1)	0	1 (1)	100.0
0500-0599	0	0	0	0	2 (2)	2 (2)	100.0
0600-0699	0	0	0	8 (5)	0	8 (5)	62.5
0800-0899	2 (1)	0	0	0	17 (7)	19 (8)	42.1

Study No. 3

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Unsuccessful Flights Cont'd							Failure Rate
Balloon Serial Numbers	Det 1	Det 2	Det 3	Det 4	Det 5	Total	
128TT Type Balloons Cont'd							
1100-1199	0	27 (4)	0	0	0	27 (4)	14.8
1300-1399	5 (2)	0	0	0	0	5 (2)	40.0
1400-1499	17 (3)	0	18 (4)	7	0	42 (7)	16.7
1500-1599	0	0	1	0	0	1	0
Total 128TT's	24 (6)	27 (4)	19 (4)	16 (6)	19 (9)	105 (29)	27.6
Grand Total	107 (23)	165 (14)	34 (6)	103 (40)	107 (34)	516 (117)	22.7
Failure Rate by Detachment	21.5	8.5	17.6	38.8	31.8	-	-

Figure in parenthesis to right of column denotes number of known failures by series.

Study No. 3 (cont'd)

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Balloon Serial Numbers	Successful Flights						Percent Successful
	Det 1	Det 2	Det 3	Det 4	Det 5	Total	
66GT Type Balloons							
0000-0099	10	22 (6)	0	0	1	33 (6)	18.2
0100-0199	0	23 (9)	1	2	0	26 (9)	34.6
0200-0299	4	1	3	7	9	24	0
0300-0399	7 (1)	0	0	20	8	35 (1)	2.9
0400-0499	15 (2)	1	3	0	8	27 (2)	7.4
0500-0599	0	1	8 (1)	34	0	43 (1)	2.3
0600-0699	0	55 (7)	0	18 (1)	7	80 (8)	10.0
0700-0799	21 (1)	1	0	0	47 (2)	69 (3)	4.3
0800-0899	26 (1)	0	0	5	0	31 (1)	3.2
0900-0999	0	11 (3)	0	1	0	12 (3)	25.0
1000-1099	0	22 (10)	0	0	7 (3)	29 (13)	44.8
1100-1199	0	0	0	0	1	1	0
Unknown	0	1	0	0	0	1	0
Total 66GT's	83 (5)	138 (35)	15 (1)	87 (1)	88 (5)	411 (47)	11.4
128GT Type Balloons							
0000-0099	0	0	0	1	0	1	0
0500-0599	0	0	0	0	2	2	0
0600-0699	0	0	0	8	0	8	0
0800-0899	2	0	0	0	17 (5)	19 (5)	26.3

Study No. 4

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Successful Flights Cont'd						
Balloon Serial Numbers	Det 1	Det 2	Det 3	Det 4	Det 5	Percent Successful
128TT Type Balloons Cont'd						
1100-1199	0	27 (10)	0	0	0	27 (10) 37.0
1300-1399	5	0	0	0	0	5 0
1400-1499	17 (2)	0	18 (2)	7	0	42 (4) 9.5
1500-1599	0	0	1 (1)	0	0	1 (1) 100.0
Total 128TT's	24 (2)	27 (10)	19 (3)	16 (0)	19 (5)	105 (20) 19.0
Grand Total	107 (7)	165 (45)	34 (4)	103 (1)	107 (10)	516 (67) 13.0
Successful by Detachment	7.5	27.3	11.8	1.0	9.3	-

Figure in parenthesis to right of columns denotes number of known successful by series.

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TAB N

ANALYSIS OF BALLASTING

PERFORMANCE

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I. RECONSTRUCTION OF BALLASTING PERFORMANCE OF SOME RECOVERED BALLOONS

A. The balloon vertical profiles prepared by Aeronautical Chart and Information Center from the Hazel data were examined in an attempt to reconstruct the ballasting performance of some successfully recovered project balloons. An attempt was also made to correlate the vertical fluctuations observed in the profiles of the balloons with the topography over which the balloons travelled. Thirty-eight (38) profiles were available as of this date (12 March 56) and these form the basis for this study. Four (4) others which have been returned are classed as aborts and profiles for these are not available. (S)

B. The analysis consisted of first comparing the vertical profiles to the geographical index also provided by Aeronautical Chart and Information Center. With the comparisons, "suntimes" along the profiles were computed and pertinent topographic features along the balloon path were noted. Using the theoretical weight-altitude relationship for each balloon type, and considering the gain in altitude on succeeding days of flight, the ballast expenditure was computed. A summary of ballasting performance of recovered balloons is given in Inclosure 1. A brief description and a graph of each of the reconstructed flights are provided as Inclosures 2 through 39 to this Tab. (S)

1. In the inclosures, the vertical profiles of the balloons are indicated in graphical form. The solid portion of the profile is a schematic giving an approximate and smoothed representation of the profile taken from the hazel data. The dashed portion of the curves are reconstructions of the flight during the night mode of operation and other times when the hazel unit was not activated. The abscissas on these curves are "local meridional times (L)", the sun time at the nearest meridian to the balloon's position. For example, if a balloon were located over 32.2°N and 21.6°E at 0130Z, the local time would be given as $0130 + 4 \text{ minutes times } 22^{\circ} = 0258\text{L}$. The vertical lines in these graphs are at midnight local time. (C)

2. In addition, the approximate latitude belt in which a balloon travelled in any particular day is also shown as well as the period (referred to local meridional time) during which the hazel unit was activated. If the local time could not be estimated due to lack of knowledge of exact locations, then the GCT time is shown. An "X" in the "Hazel on" entry indicates that the hazel unit was not activated on that day. (U)

3. The percent of clouds figure shown on each day is the

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estimate made by Aeronautical Chart and Information Center of the average percent of cloud cover in the photographic frames for that day on a specific flight. The "maximum altitude" shown is the maximum altitude attained by the balloon on that day as estimated from the vertical profile. Two figures may be shown here if the balloon descends during the day and then ascends again to another significant maximum altitude. (S)

4. The amount of ballast used during a particular day was divided by the estimated gross weight of the balloon as it began that particular day. This figure is shown as the daily ballast rate on the graph at the "ballast" entry. The estimated amount of ballast used is shown below the profile in pounds, a question mark here indicates that the balloon probably ballasted but the amount cannot be estimated. (U)

5. Finally, certain notes which are believed to be significant and revealing of ballasting performance and possible causes for excessive or daytime ballasting are included for each flight in a "Remarks" section. (U)

6. The underlying assumption in this study is that the progressive daily increase in maximum altitude reached by the balloon is a direct measure of the ballast expended during the intervening ballasting periods. This is a valid assumption if the balloon does in fact reach its attainable altitude each day, where the attainable altitude is the maximum altitude that the balloon could reach if it were limited only by its gross weight. If forces should act to restrict the balloon from ascending to this attainable altitude on a particular day, the computation of daily ballast expenditure would show too little ballast dropped on the previous night and too much on some subsequent night preceeding a day on which the attainable altitude was first reached. For this reason, the daily ballast consumption rates are individually suspect; however, the average of these rates is believed to be a reliable indication of ballasting performance. (U)

C. Results of the study were as follows:

1. A large portion of the balloons studied exhibited vertical fluctuations of considerable magnitude during times when such occurrences were not expected. Of the 33 balloons studied, 35 (92%) descended from floating altitudes during the day prior to about 1500 local time on one or more days of their flight. These vertical fluctuations were of such magnitude that 32 balloons (84%) gave evidence of having ballasted during the day. (U)

2. Instead of the theoretical 7% ballasting rate expected,

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the mean average rate for the 33 balloons was 9.5% with individual balloons varying in average rates from 4.1% (CIE-1) to 18.5% (ADA-91). Based on the small sample at hand, the 128TT balloons have a higher ballast rate than the 66CT and the balloons from Detachment 2 have a higher rate than those from the German sites, Detachments 1 and 5. A detailed summary of these data are given in Inclosure 1. (C)

3. Due to these excessive ballast rates, the reconstructed profiles indicate that the life expectancy is somewhat shorter than the theoretical life of 7 and 8 days for the 66CT and 128TT respectively. Based on the average ballast rate, life expectancies were computed for the 33 balloons. The following was noted:

Days Life Expectancy	66CT	128TT
3	1	
4	8	2
5	4	1
6	8	5
7	3	1
8	2	1
10	1	
12	<u>1</u>	<u> </u>
Total	23	10

Of the 66CT balloons, 75% were computed to fall short of the 7 day life expectancy and 90% of the 128TT balloons would have lived less than 8 days. (C)

D. It should be recalled that this analysis is based on successful balloon flights; that is, on balloons which were actually recovered after having completed a journey of several thousand miles. Of course, the majority of successfully launched balloons did not complete this journey and their ballasting performance is not known. However, it is not unreasonable to assume that the data derived as a result of this study are biased toward lower ballast rates and longer life than might be expected if the entire population of successfully launched balloons could have been considered rather than this "successful" sample. In any case, the departures from theoretical profiles and ballasting rates noted in this study seem to have resulted in a significant reduction in balloon life from that which has been heretofore expected. Among the causes for such departures may be included one or a combination of the following: (C)

1. Radiative effects. Profiles indicated that balloons

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descended, frequently to ballasting level, where the radiative balance on the balloons was changed by passing from open to cloud or snow covered terrain or when passing from a land to water surface. (U)

2. Mechanical turbulence. Profiles indicated that balloons descended, frequently to ballasting level, after passing over mountain ranges (even relatively small ones) oriented roughly normal to the direction of travel. (U)

3. Anomalous descents during daylight periods which cannot be readily explained by radiative or mountain wave hypotheses may be the result of vertical currents caused by dynamic instability in the air currents themselves. The triggering action setting up these phenomena may occur many hundreds of miles upstream. (U)

E. Recommendations based on these studies are as follows:

1. Increase the vertical separation between the initial and base altitudes as much as possible. If the separation were larger, some of the forces causing balloon descent might diminish, reverse, or be counter-balanced by other forces during the longer time interval that would be required to cover the increased separation. (U)

2. Increase the amount of ballast on those balloon flights expected to traverse particularly mountainous terrain. (U)

F. A phenomena peculiar to 128TT balloons which have had a portion of the venting duct removed was explained to this headquarters by a representative of Cambridge Research Center, which might account for unusual ballasting or higher initial altitudes than planned. Inasmuch as the majority of 128TT's were launched in the early part of the program, a time in which initial altitude measurement by radiosonde or MSQ-2 radar was not always available, the ability to analyze balloon performance on ascent did not exist. However, since the phenomena could exist, it is explained here as a possible cause of unusual 128TT ballast consumption. The phenomena is based on the theory that 128TT's with short venting ducts and high percentages of free lift, will exceed the planned initial altitude, "belch gas" through the duct, and as a result, descend. As noted in some of the attached profiles, initial altitudes higher than planned altitudes were reported; however, the number of these occurrences is small and therefore the actual occurrences of the belching could not be identified. For this reason, belching was discounted in the study of performances contained herein. It is recommended that the phenomena be closely studied. (S)

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G. At the same time that the Cambridge Research Center representative advanced the theory in paragraph F above, he explained the working of the auxiliary ballast control as being such that perhaps the incorrect ballasting altitude settings were being used in the operation. Simply stated, we were setting the auxiliary ballast control aneroid at the desired ballasting altitude, whereas he explained, to actually float at that altitude the aneroid setting should be approximately 1,500 to 2,000 feet above the desired level-off altitude. This statement caused great concern, particularly because it came at a time when large numbers of balloons were being launched and never heard from. It was natural to assume that perhaps balloons were actually floating at about 38,000 feet during the twilight periods as against a planned minimum of 40,000 feet. At that time approximately 20 vehicles had been returned and processed and Hazel data plots were available for study. Based on the statement of the Cambridge Research Center representative, it was expected that the study would reveal many instances of balloons floating below the planned minimum altitude. This was not the case however, of those on hand at the time; all balloons indicated precise floating at the desired minimum altitude which corresponded to the aneroid control settings. For this reason, aneroid settings were not changed to 1,500 to 2,000 feet above desired altitude as recommended. The plots of Hazel data obtained from subsequently returned vehicles continued in this pattern. The fact that balloons did not fly lower, as they should have due to the workings of the auxiliary ballast control, cannot be explained from the data on hand. The explanation may lie however, in the inherent inaccuracy of the means of presentation of the data plots. That is to say, that in a scale wherein approximately 1/8" is a thousand feet, that errors of 300 to 500 feet can not be discerned because of the width of the inked plot. It is believed that a more precise study is required and that balloon operations of the future should be afforded the results of such a study. (S)

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A SUMMARY OF BALLASTING PERFORMANCE
OF SOME RECOVERED BALLOONS

Flight Number	Flight Time (hrs)	Average Ballast Rate	Number of Computed	Sunsets Actual	Daylight Descents	Daylight Ballast
German Sites - 128TT						
GIE-23	97	9.3%	5	5	2	2
GIE-31	97	9.6	5	5	2	2
GIE-32	92	7.0	7	4	1	1
OBE-14	114	8.0	6	5	No	No
OBE-32	91	9.8	5	4	1	1

Average ballast rate of OBE and GIE 128TT balloons - 9.7%.

ADA-128TT

ADA-3	67	13.1%	3	3	2	1
ADA-4	65	9.2	5	2	1	No
ADA-6	62	10.0	5	3	1	1
ADA-7	74	12.4	3	3	2	1
ADA-47	64	11.4	4	3	2	2

Average ballast rate of ADA 128TT balloons - 11.2%.

German Sites - 66CT

GIE-1	217	4.1%	11	8	No	No
GIE-51	Unk	5.6	7	5	2	2
GIE-102	109	7.9	5	4	1	1
OBE-8	127	7.8	5	5	2	2
OBE-55	128	7.0	6	5	2	2
OBE-57	128	7.3	6	5	3	3

Average ballast rate of OBE and GIE 66CT balloons - 6.6%.

ADA-66CT

ADA-29	68	6.0%	7	2	1	No
ADA-34	Unk	13.1	3	2	2	2
ADA-36	65	7.2	6	3	1	1
ADA-40	71	10.2	4	4	2	1
ADA-48	68	8.0	5	3	No	No
ADA-52	63	9.0	4	3	1	No
ADA-54	72	11.0	3	3	2	2
ADA-56	52	11.0	3	2	2	2
ADA-60	54	8.0	5	2	2	2
ADA-61	52	12.2	3	3	2	1
ADA-62	51	10.8	4	3	2	1
ADA-66	67	7.9	5	4	2	1
ADA-67	50	12.2	3	2	2	2
ADA-69	55	11.7	3	2	2	2
ADA-77	57	8.0	5	2	1	1
ADA-85	53	11.5	3	3	2	2
ADA-88	61	7.6	5	2	2	2
ADA-89	58	9.3	4	2	4	1
ADA-91	Unk	18.5	2	2	3	3
ADA-142	67	8.8	5	3	2	2

Average ballast rate of ADA 66CT balloons - 10.2%.

EVA-66CT

EVA-50	158	6.4%	9	7	2	1
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Incl 1

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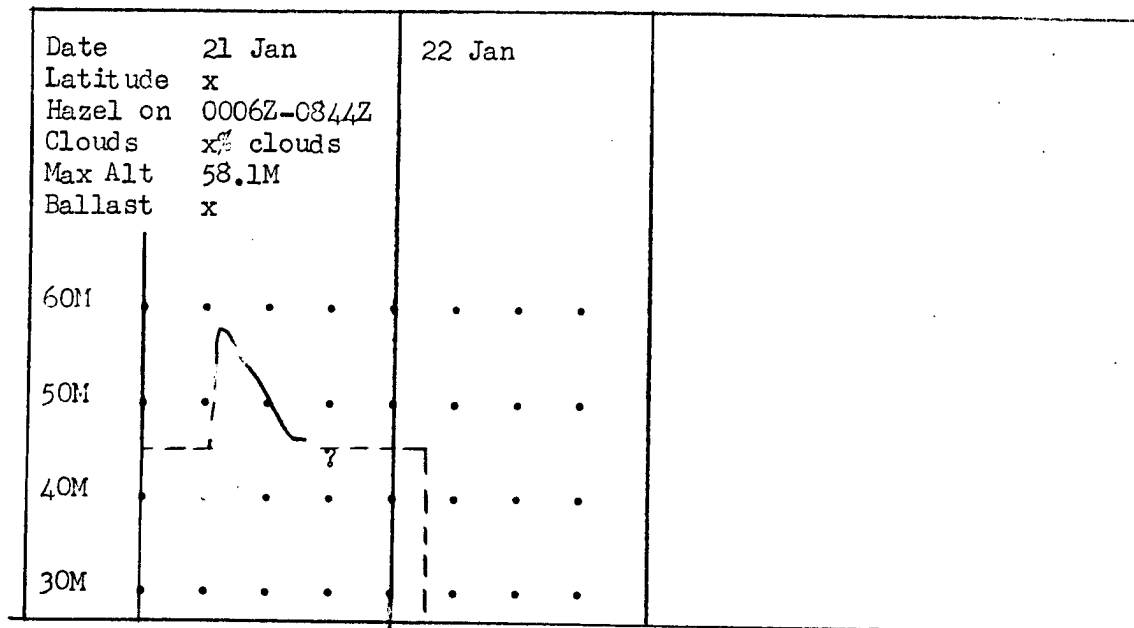
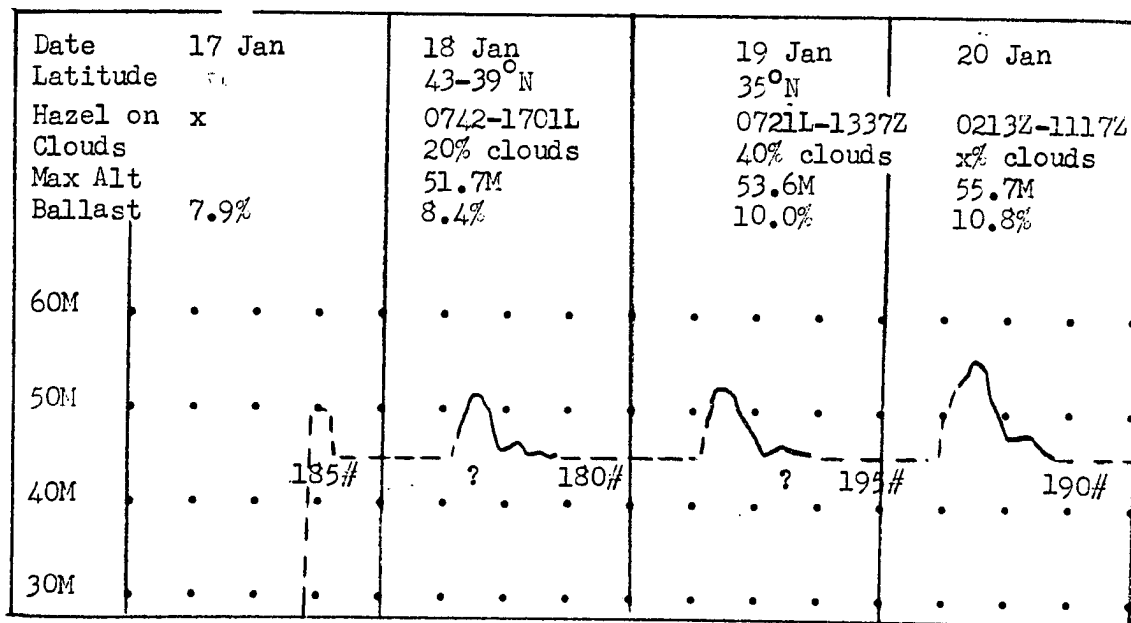
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GIE-23

Type 128TT

Launched 17/1650Z Jan 1730L
 Terminated 21/1752Z Jan 22/0316L
 Enroute 97 hrs 02 min

Planned Initial Altitude 50.0M
 Measured Initial Altitude 43.0M
 Base Altitude 45.0M



Incl 2

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GIE-23 (Cont'd)

REMARKS:

1. The average daily ballast rate for this balloon was 9.3%. At this rate the balloon would have expired after a maximum of 6 days.
2. Apparently the balloon ascended to its initial altitude and immediately descended to base altitude and ballasted on the night of the 17th.
3. Assuming that the duct was cut properly and the gross weight was 2325#, this balloon used at least 750# of ballast on four nights and had at most 205# left to be used on the night of the 21st. At the rate this balloon ballasted, it probably would not have survived sunset of the 22d.
4. On every day, the balloon showed a steady descent immediately after reaching its maximum altitude. It may have been leaking gas, requiring it to dribble ballast to maintain its base altitude at night. This of course could explain its heavy ballast rate.
5. On the 18th, it began its descent while passing over the Black Sea. On the 19th began its descent over foothills, reaching its base altitude on the lee side of a ridge about noon. Equipment malfunction precludes correlating the vertical profile with orography on the 20th and 21st.

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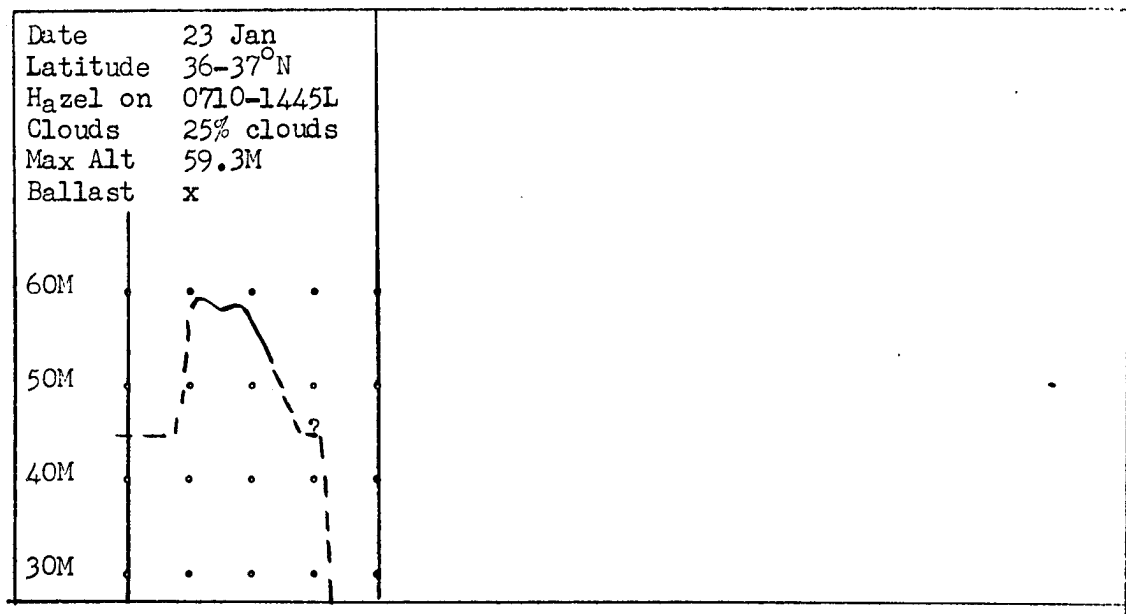
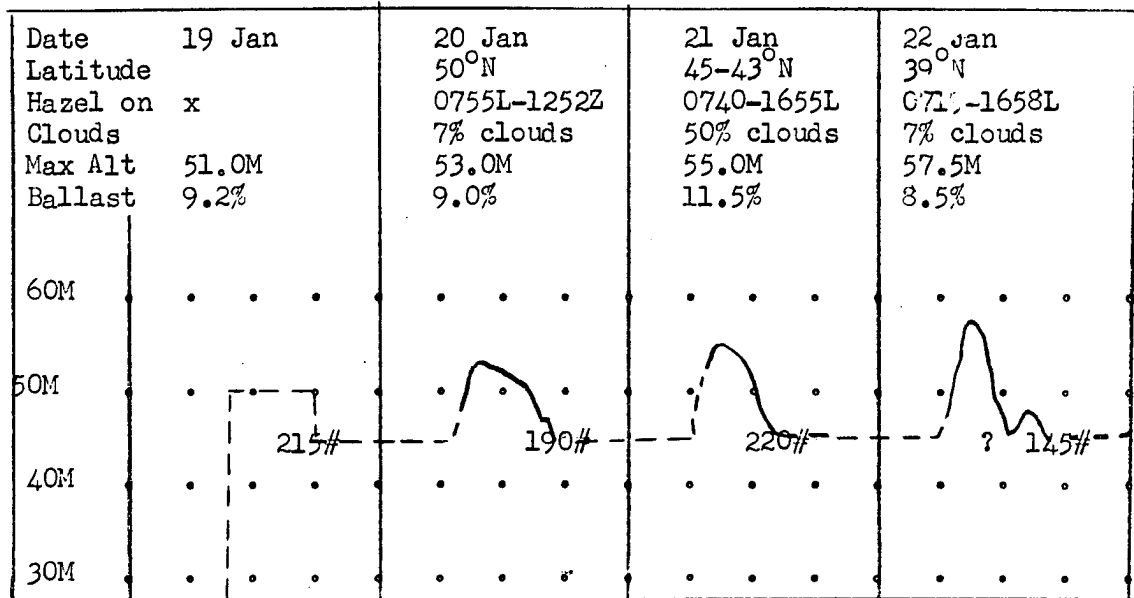
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GIE-31

Type 128TT

Launched 19/0920Z Jan 1000L
 Terminated 23/1044Z Jan 2000L
 Enroute 97 hrs 24 min

Planned Initial Altitude 50.0M
 Measured Initial Altitude 57.0M
 Base Altitude 45.0M



Incl 3

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REMARKS: GIE-31 Cont'd

1. The average daily ballast rate for this balloon was 9.6%. At this rate the balloon would have expired after a maximum of 5 days.
2. The initial altitude was probably a little higher than planned but certainly not as high as "measured". Since it is necessary to know the initial altitude to make a ballast computation for the 128TT balloon, one will have to be assumed; 51.0M would be commensurate with the subsequent data, and 50.0M will also be used.
3. Using 50.0M as the initial altitude, the balloon used 840# of ballast and had at most 125# left. In this case the daily ballast rate averages 10.6%.
4. Using 51.0M as the initial altitude, it used 770# and had at most 195# left.
5. In any case, the average ballasting rate was about 10%; and, at that rate, the balloon would have used about 150# of ballast at sunset of the 23d (the fact that it did survive that sunset argues for the higher initial altitude) so that the balloon at most could have lasted no longer than to sunset of the 24th.
6. This balloon came to ballasting altitude about 1400L on the 21st and about noon on the 22d; on both days it was over hilly country getting into mountains about midday of the 22d.

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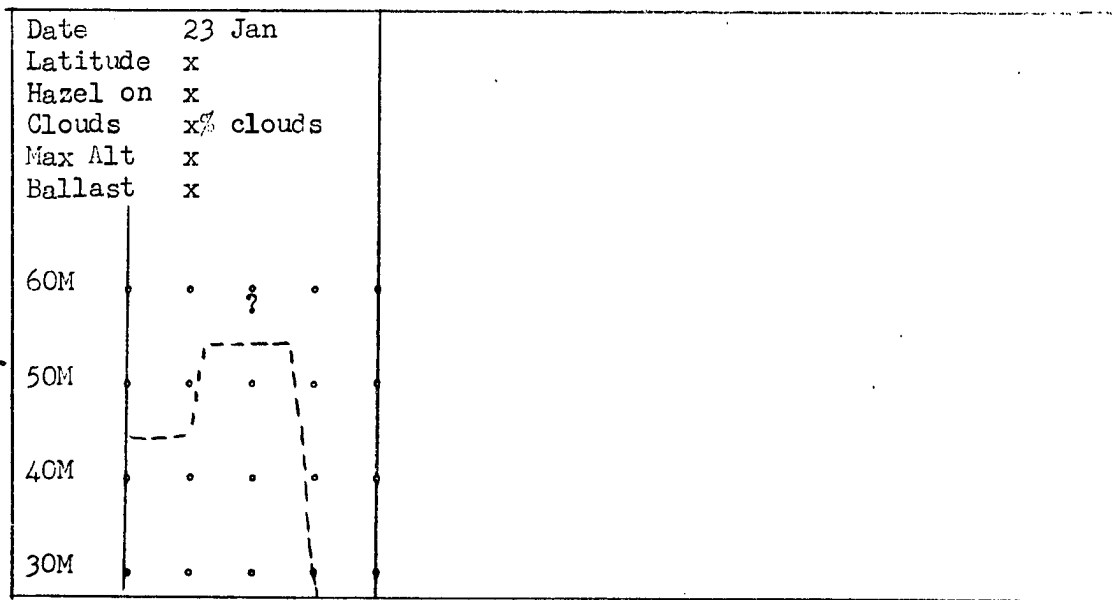
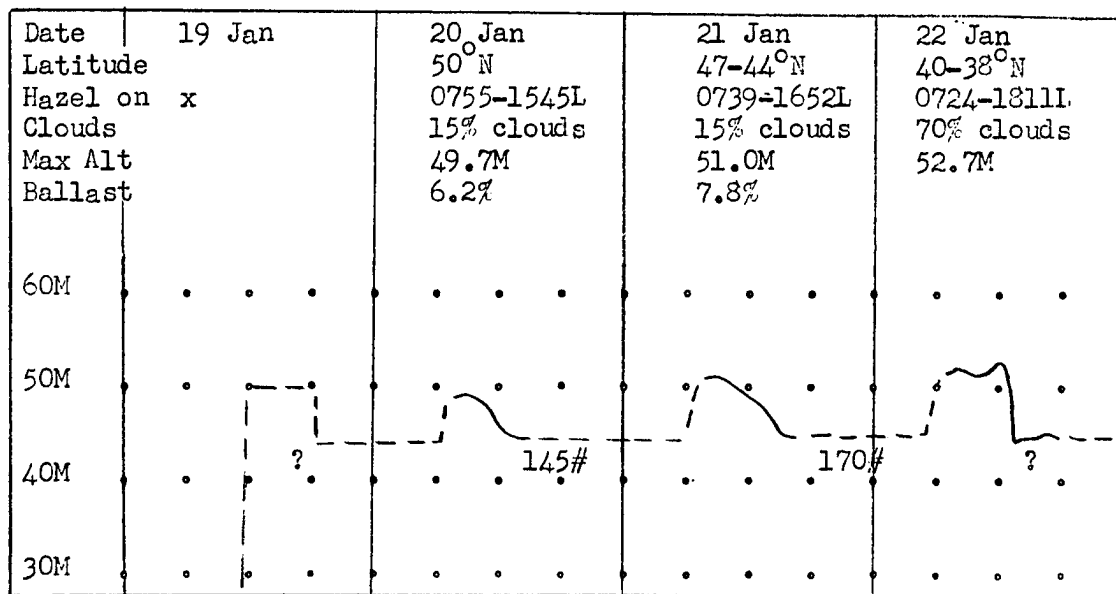
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GIE-32

Type 128TT

Launched 19/1037Z Jan 1117L
 Terminated 23/0610Z Jan 1650L
 Enroute 91 hrs 33 min

Planned Initial Altitude 50.0M
 Measured Initial Altitude 47.6M
 Base Altitude 45.0M



Incl 4

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REMARKS: (ALL-32 Cont'd)

1. The average daily ballast rate for this balloon was 7.0%. At this rate the balloon would have expired after a maximum of 2 days.
2. The balloon was over lowlands on the 20th and the morning of the 21st. It passed over a mountain ridge about 1400L of the 21st.
3. On the 22d, it crossed a high ridge about noon and began to descend shortly thereafter, due possibly to the mountain wave effect or turbulence.
4. This balloon should have ballasted on the night of the 19th, either it did not or the duct was cut short.
5. No data for the 23d was received from ACIC.
6. Assuming no ballast expenditure on the 19th, used 315# through the 21st and had at most 640# left.
7. At 7%, should have used 315# for 2 sunsets, and 455# for 3.

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REMARKS: (CRE-14 Cont'd)

1. The average daily ballast rate for this balloon was 3.0%. At this rate the balloon would have expired after a maximum of 7 days.
2. It is questionable as to whether balloon ballasted on the night of the 13th, having been launched about dusk. Since the balloon leveled off at 50.0M on the 14th, will assume that it did not ballast. However, dust may have been short.
3. On the 15th and again on the 17th, the balloon undershot its base altitude and required heavy expenditures of ballast on those nights. On both days the balloon crossed small ridge just about the time it reached its base. Otherwise, this balloon behaved rather well.
4. Through the night of the 16th, at least 640# of ballast were used and at most 315# were left--some of which was used the night of the 16th.
5. At 7%, should have used 585# of ballast in these 4 periods.

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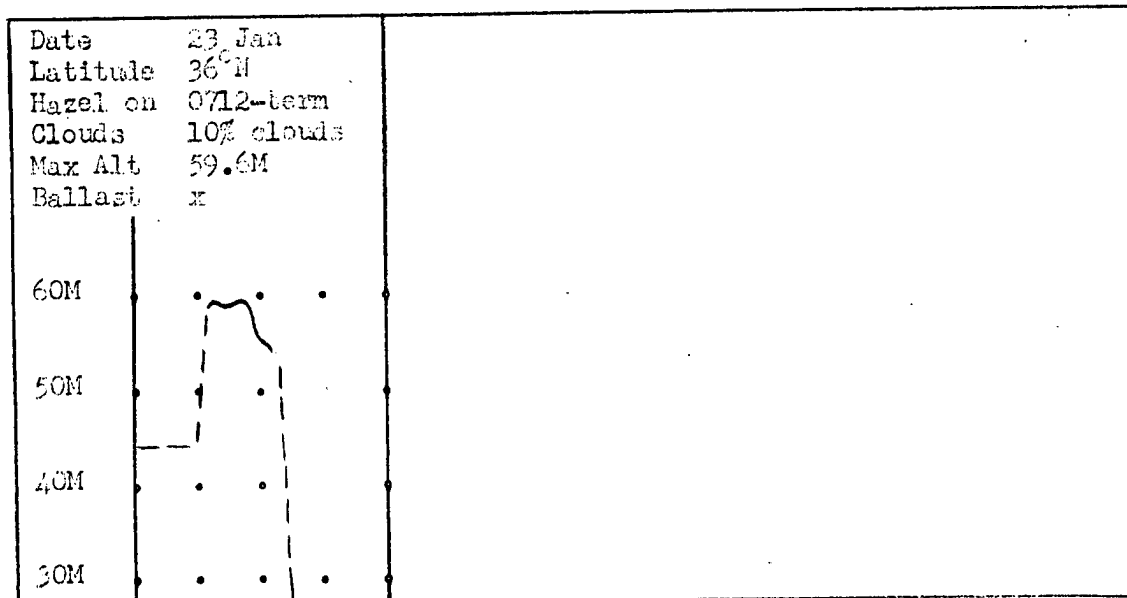
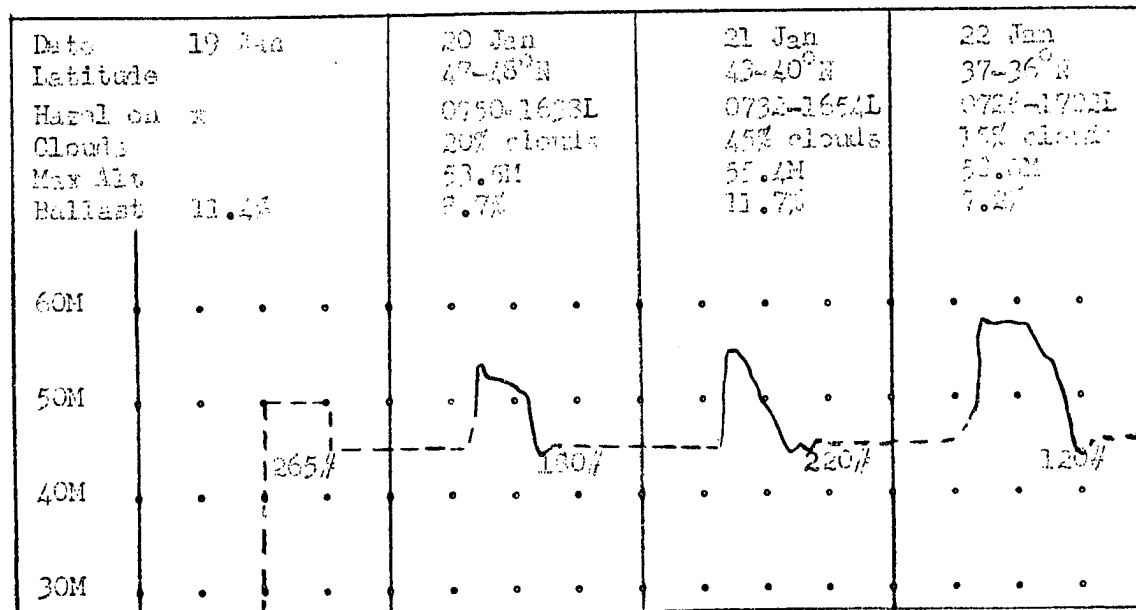
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OBE-32

Type 128TT

Launched 19/1048Z Jan 1132L
 Terminated 22/0630Z Jan 1410L
 Enroute 90 hrs 42 min

Planned Initial Altitude 50.0M
 Measured Initial Altitude 51.0M
 Base Altitude 45.0M



Incl 6

251

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OBE-32 (Cont'd)

REMARKS:

1. The average daily ballast rate for this balloon was 9.8%. At this rate the balloon would have expired after a maximum of 6 days.
2. The planned initial altitude was 50.0M whereas measurement showed it to be at 51.0M. The ballasting rate suggests that the balloon leveled off higher than planned.
3. Assuming initial altitude of 51.0M, 785# of ballast were used in 4 days with at most 170# left.
4. If the initial altitude were 50.0M, 860# were used with at most 105# left. If this were the case, the average daily ballast rate was 10.8%.
5. At 7%, 585# of ballast should have been required for 4 ballasting periods.
6. On the 20th the flight was over lowland and marshy areas. The balloon descended to base altitude about 1400L rather abruptly, possibly due to an earthset.
7. On the 21st, the flight was over mountains and ridges with peaks to 14.0M. The more gradual descent over a longer period with arrival at base about 1300L suggests turbulence as a factor although the high percent of clouds also argues for a possible earthset.
8. On the 22d, the flight was over a marshy area, it stayed at altitude until after it entered over hills. The descent began about 1500L, and so may be normal. Undershot base.

252

D-582

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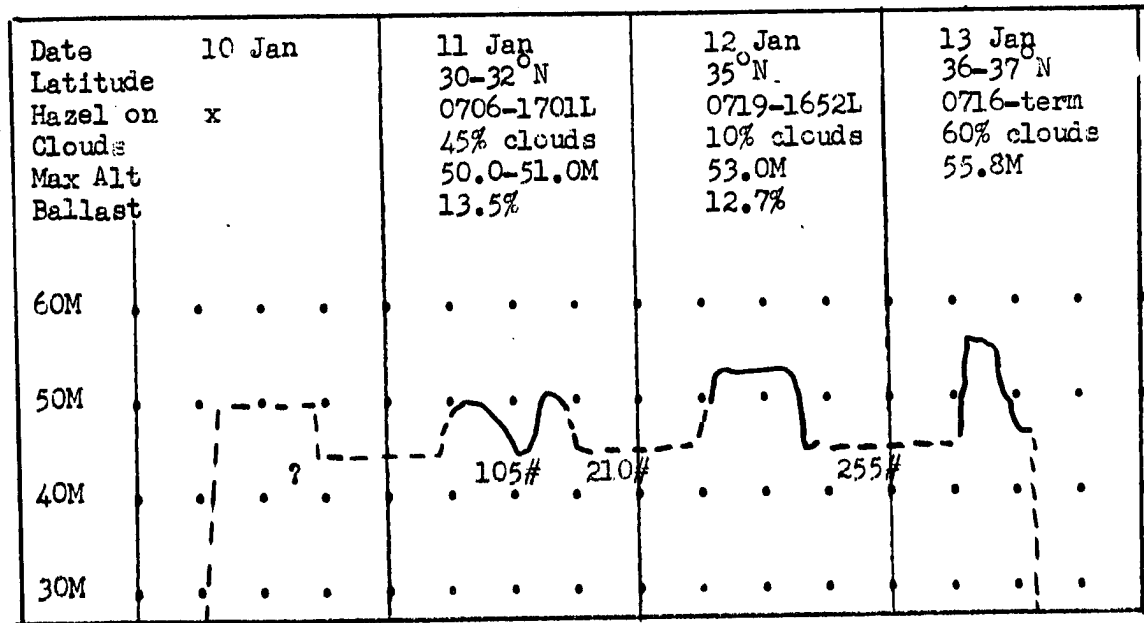
TOP SECRET

ADA-3

Type 128TT

Launched 10/0637Z Jan 0901L
 Terminated 13/0400Z Jan 1328L
 Enroute 67 hrs 23 min

Planned Initial Altitude 50.0M
 Measured Initial Altitude None
 Base Altitude 45.0M

**REMARKS:**

1. The average daily ballast rate for this balloon was 13.1%. At this rate the balloon would have expired after a maximum of 4 days.
2. This balloon was released in the morning and it should have ballasted on the night of the 10th. It may or may not have - if its initial altitude was 50.0M, then some ballast shown as being used during the day of the 11th may have been dropped on the night of the 10th.
3. On the 11th, the balloon passed over a cloud deck and apparently experienced an earthset; it descended to 44.0M and undoubtedly ballasted near noon local time.
4. On the 12th, the balloon ballasted about 1500L after passing mountains; there is some evidence of a mountain wave effect here.
5. If the gross weight were 2325# and the duct was cut properly, then the flight used at least 570# of ballast, with at most 390# left.
6. At 7% with the above assumptions, it should have used 455#.

Incl 7

253

D-582

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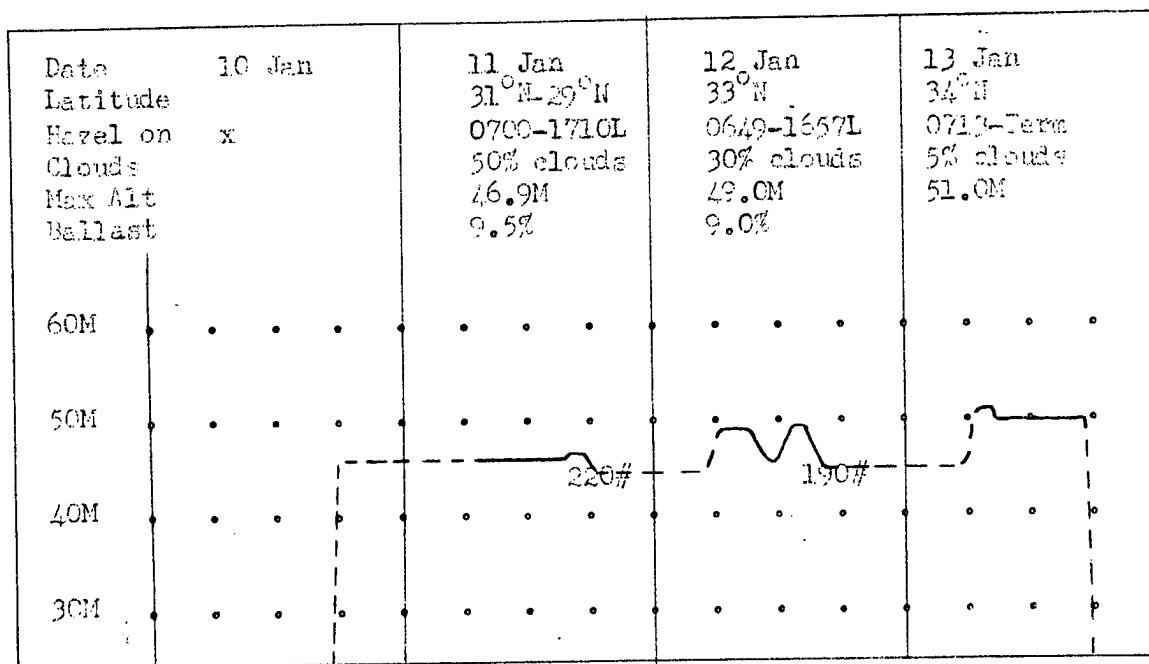
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ADA-4

Type 128TT

Launched 10/1513Z Jan 1737L
 Terminated 13/0804Z Jan 1656L
 Enroute 64 hrs 51 min

Planned Initial Altitude 50.0M
 Measured Initial Altitude None
 Base Altitude 45.0M



REMARKS:

1. The average daily ballast rate for this balloon was 9.2%. At this rate the balloon would have expired after a maximum of 6 days.
2. Apparently this balloon did not reach its planned initial floating altitude. The duct may have been cut short.
3. Assuming a short duct and gross of 2325#, this balloon used at least 410# ballast and had at most 547# left.
4. At 7% with above assumptions, it should have used 315# ballast.
5. The descent to 46.0M near midday of the 12th, may be due to the balloon's crossing mountains with peaks to 20.0M at that time.

Incl 8

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TOP SECRET

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ADA-6

Type 128 TT

Launched 10/1938Z Jan 2202L
 Terminated 13/0942Z Jan 1818L
 Enroute 62 hrs 04 min

Planned Initial Altitude 50.0M
 Measured Initial Altitude None
 Base Altitude 45.0M

Date	10 Jan	11 Jan	12 Jan	13 Jan
Latitude		34-31°N		
Hazel on	x	0806-1710L	0207Z-1110Z	2352-0837Z
Clouds		15% clouds	x% clouds	x% clouds
Max Alt		47.8M	49.7-50.6M	52.1M
Ballast		8.8%	11.1%	
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 10.0%. At this rate the balloon would have expired after a maximum of 6 days.
2. This was a night-time launch and the balloon should have stayed at its initial altitude until sunset of 11th. Assume 47.3M is initial altitude.
3. On the 11th, the balloon descended to its base altitude during the morning and ballasted. The balloon descended to 44.2M about 3 hours before hazel off time.
4. On the 13th the balloon ballasted after descending to 43.2M about 90 min before the hazel unit went off.
5. Through the 12th, 440# of ballast were expended at least and at most 520# remained, some of which was used on the 13th.
6. At 7%, should have used 315# through the 12th.
7. Correlation of the vertical profile with topography and local timer cannot be made due to malfunction of the camera.

Incl 9

255

D-582

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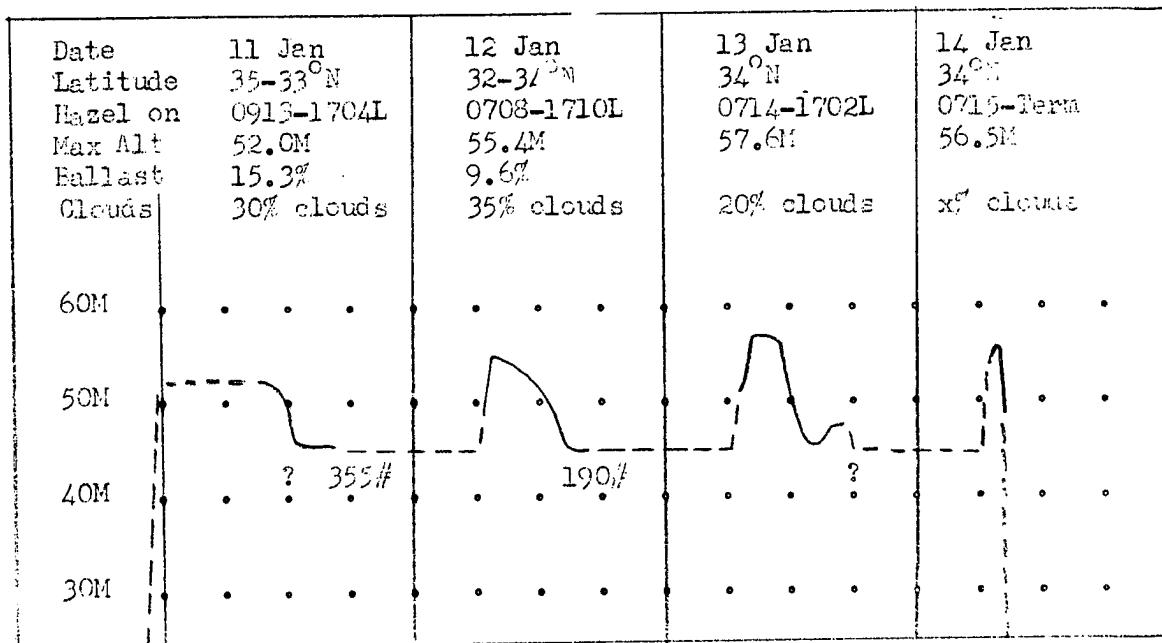
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ADA-7

Type 123TT

Launched 10/2043Z Jan 2312L
 Terminated 13/2246Z 14/0310L
 Enroute 73 hrs 58 min

Planned Initial Altitude 50.0M
 Measured Initial Altitude 40M
 Base Altitude 45.0M



REMARKS:

1. The average daily ballast rate for this balloon was 12.4%. At this rate the balloon would have expired after a maximum of 4 days.
2. This was a night launch and the balloon should have leveled off and been at its initial altitude sunrise of the 11th. Either it ballasted on the night of the 10th, the duct was cut long, or this was a leaker requiring almost constant ballast dribbling to maintain its base altitude.
3. Assuming a long duct, and an initial altitude of 52.0M, it used 545# ballast through the 12th at least. It should have used 315# at 7%.
4. Assuming that 50.0M was the initial altitude and the balloon either ballasted on the night of 10th or it was a leaker, it would have used 710# ballast through the 12th with at most 250# left. At the rate this balloon was ballasting, most of this 250# would have been used on the night of the 13th and the balloon could not have survived sunset on the 14th. The average daily ballast rate in this case would have been 16.4%.

Incl 10

236

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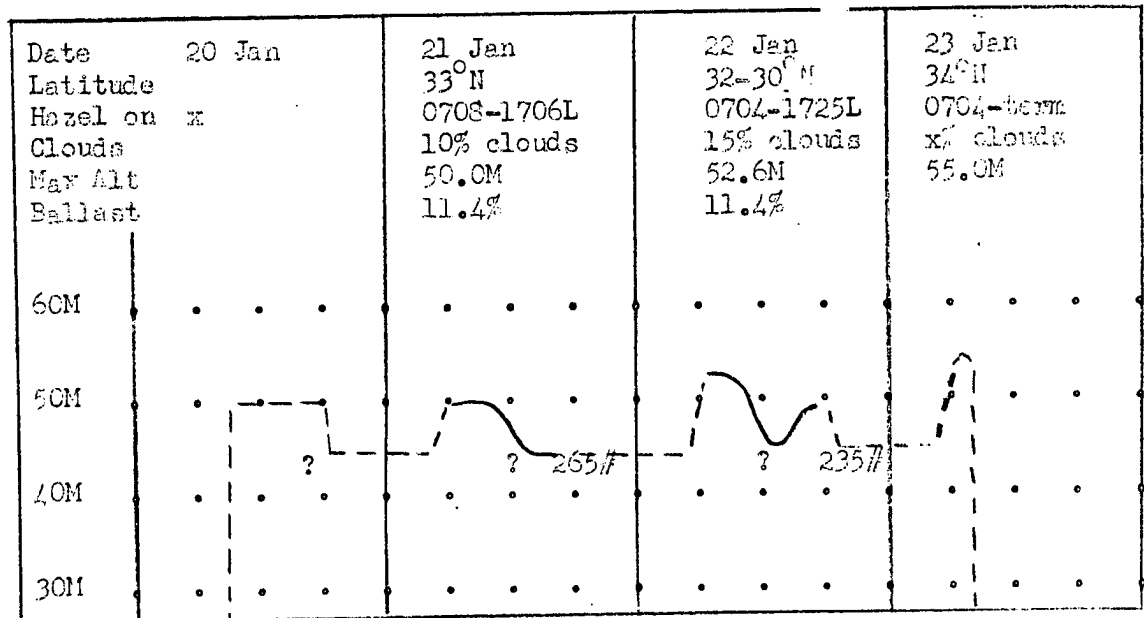
TOP SECRET

ADA-47

Type 128TT

Launched 20/0654Z Jan 0918L
 Terminated 22/2042Z Jan 23/0538L
 Enroute 63 hrs 47 min

Planned Initial Altitude 50.0M
 Measured Initial Altitude None
 Base Altitude 45.0M



REMARKS:

1. The average daily ballast rate for this balloon was 11.4%. At this rate the balloon would have expired after a maximum of 5 days.
2. Either the hazel clock was suddenly wrong on the last day, or the wrong time was reported for termination. More likely the latter - i.e., it would fit better if the termination was 2242Z.
3. On the 21st, the balloon began its descent after leaving a desert and crossing a saddle-back in the hills. Then it entered mountains and ballasted an unknown amount during the day.
4. On the 22d, it began to descend about noon after leaving a plateau (18.0M) and approaching 20.0M mountains and again ballasted during the day.
5. This balloon used at least 500# of ballast, and had at most 455# left.
6. The balloon should have ballasted on the night of the 20th. Some of the 265# shown on the 21st may have been dropped on the 20th, or if the duct were cut short, additional ballast above the 500# shown could have been used.
7. At 7% a balloon should have used 455# in three ballasting periods, 315# in two periods.

Incl 11

257

D-582

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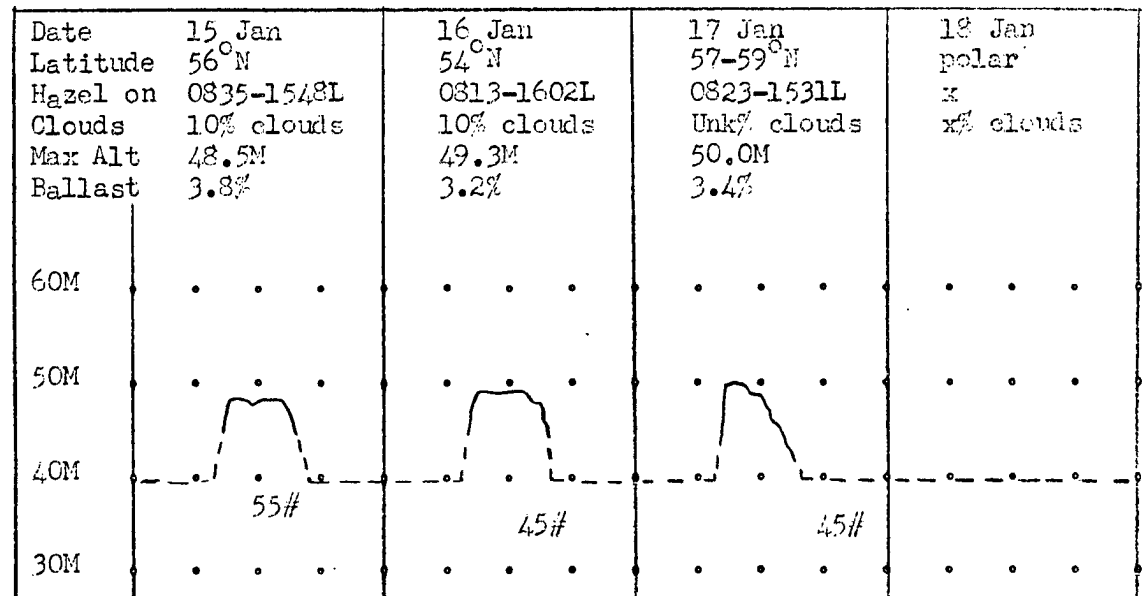
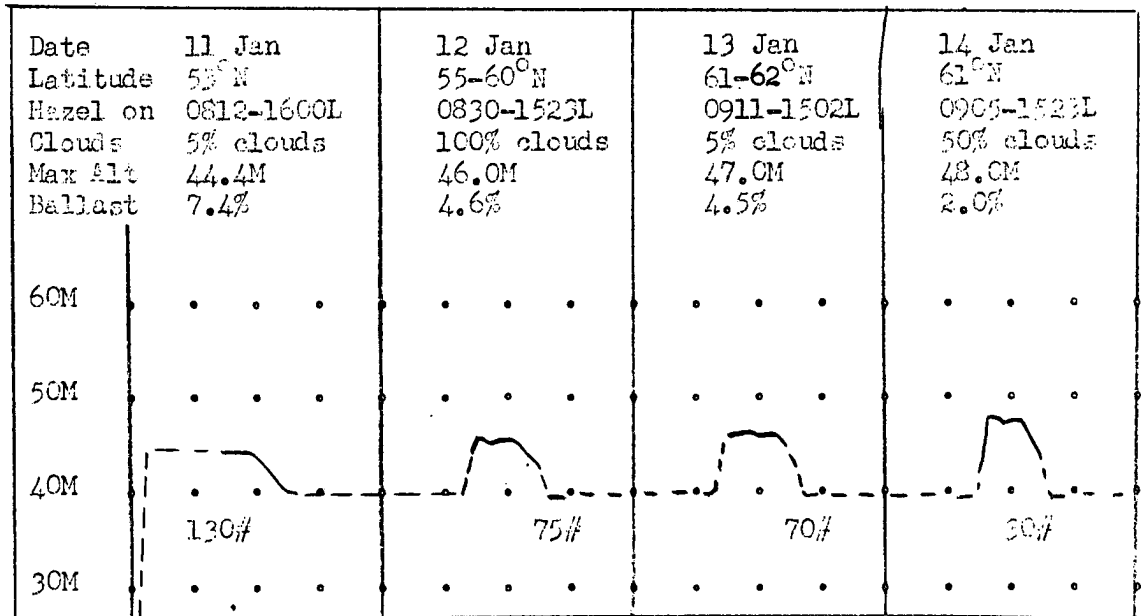
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GIE-1

Type 66CT

Launched 10/2359Z Jan 11/0039L
 Terminated 20/0110Z Jan 19/1538L
 Enroute 217 hrs 11 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude 39.0M
 Base Altitude 40.0M



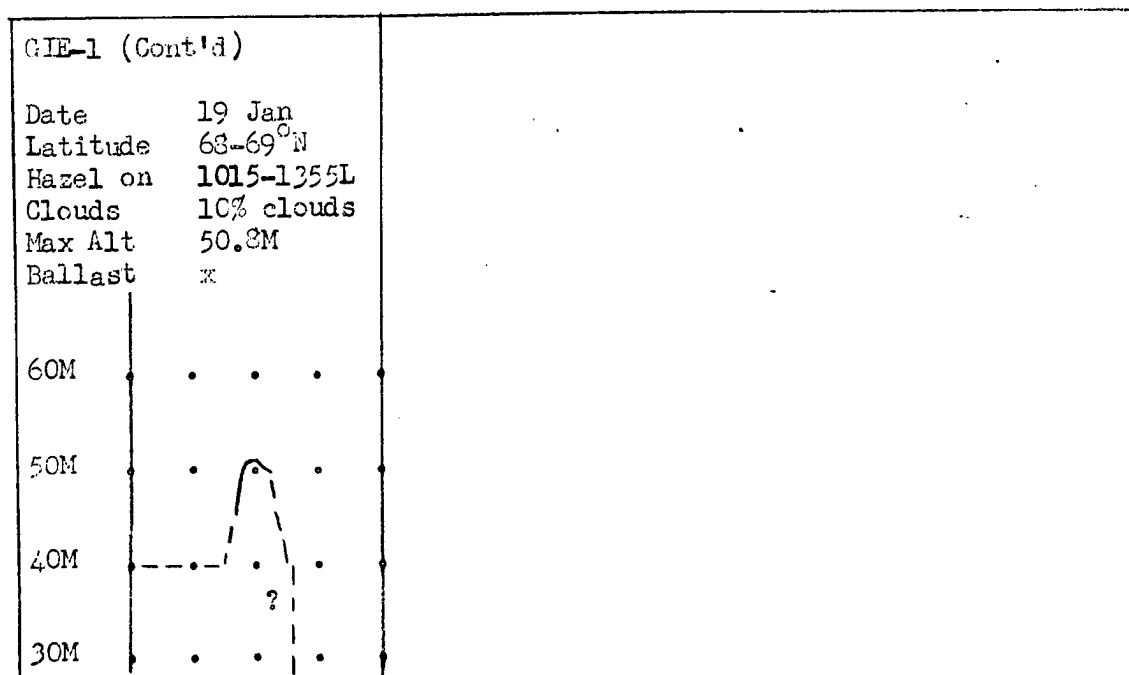
Incl 12

258

D-582

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REMARKS:

1. The average daily ballast rate for this balloon was 4.1%. At this rate the balloon would have expired after a maximum of 12 days.
2. Apparently the balloon did not reach its initial altitude of 46.4M. Will assume 44.4M was maximum altitude that could be reached due to more than planned gross weight.
3. Making the assumption that the initial gross weight was 1750#, this flight used at least 450# of ballast and had at most 295# left as it entered the 19th.
4. At 7% with gross weight of 1740#, the balloon should have had seven ballasting periods. It actually ballasted eight times at sunset and probably had enough left for three more periods at the rate it was ballasting.
5. A probable contributing factor to the low ballast rate of this flight is that it was in extreme northerly latitudes.

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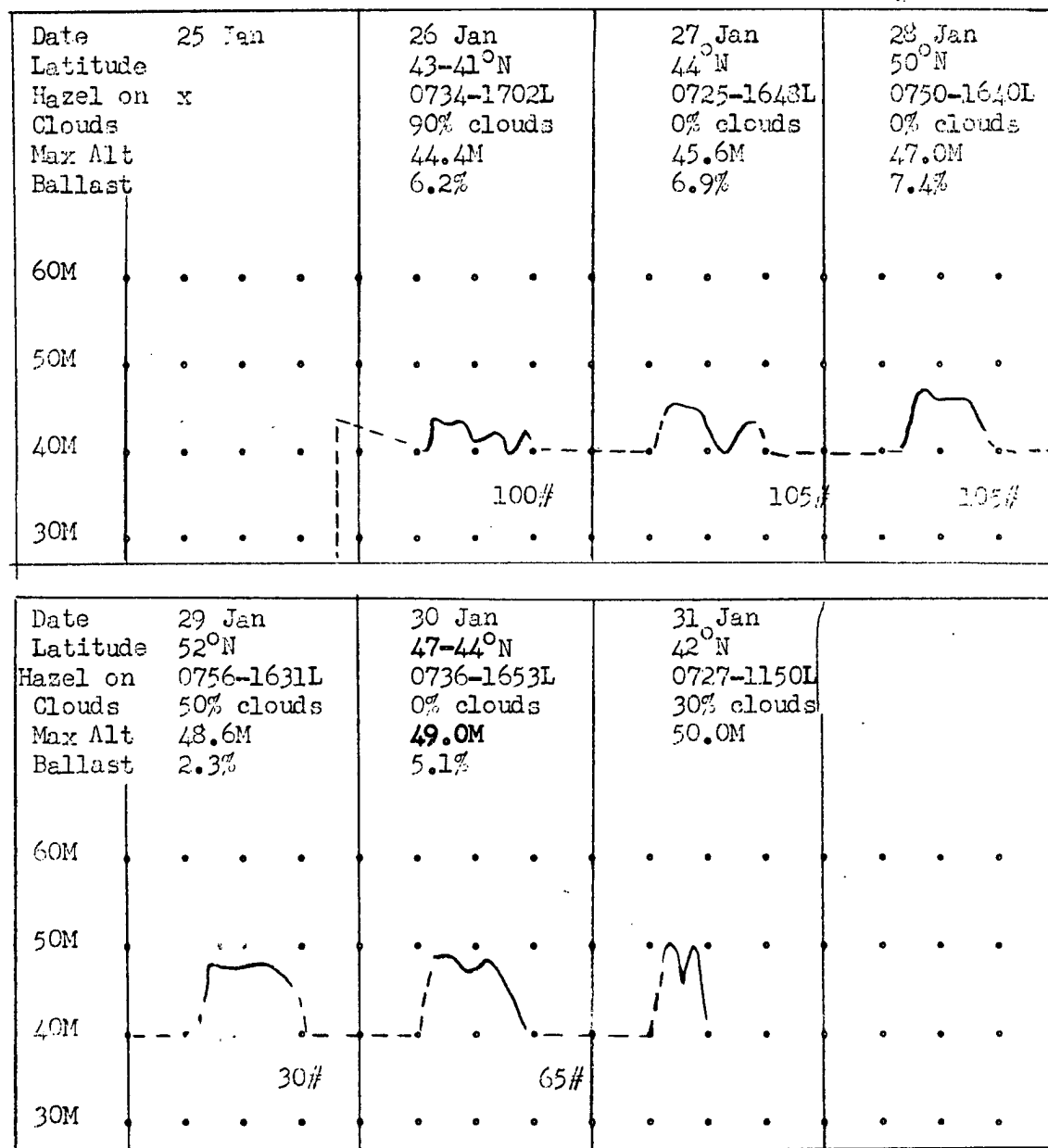
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GIE-51

Type 66CT

Launched 25/2045Z Jan 2125L
 Terminated Unk
 Enroute Unk

Planned Initial Altitude 46.4M
 Measured Initial Altitude 42.0M
 Base Altitude 40.0M



Incl 13

260

D-582

TOP SECRET

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CIE-51 (Cont'd)

REMARKS:

1. The average daily ballast rate for this balloon was 5.6%. At this rate the balloon would have expired after a maximum of 8 days.
2. This is classed as a self-terminated balloon. There is, however, nothing in its ballasting history to indicate that the termination was due to lack of ballast.
3. The balloon was launched at night and should have remained at its initial altitude through the night of the 25th. Apparently it did not since it appears to have been ascending when the hazel unit activated. Either the balloon descended to base altitude and ballasted during the night; or it overshot its initial altitude and valved gas, finally settling at some lower altitude this first night. Lacking enough data for even a fair assumption on the initial altitude, will begin this study by assuming that 44.4M was the maximum attainable altitude on the 26th.
4. With this assumption, the balloon used at least 375# of ballast and had at most 340# left on the 31st.
5. On the 26th, the balloon travelled over hilly country and seemed to follow a fairly turbulent looking profile, slowly descending and arriving at base altitude about 1500L.
6. On the 27th, the balloon travelled over the Black Sea all day, the daylight descent and probable ballasting about 1330L cannot be ascribed to either topographic or cloud effects.
7. Subsequent travel on the 28th through the 30th was over fairly level to hilly terrain and the balloon behaved rather well. On the 31st, the rather abrupt descent to 46.2 occurred in the morning just after the balloon left the land surface and entered over water; it regained its altitude apparently without ballasting.
7. The last hazel plot was at 0251Z on the 31st. The last geographical position was about 2½ hours prior as the balloon left the coast.

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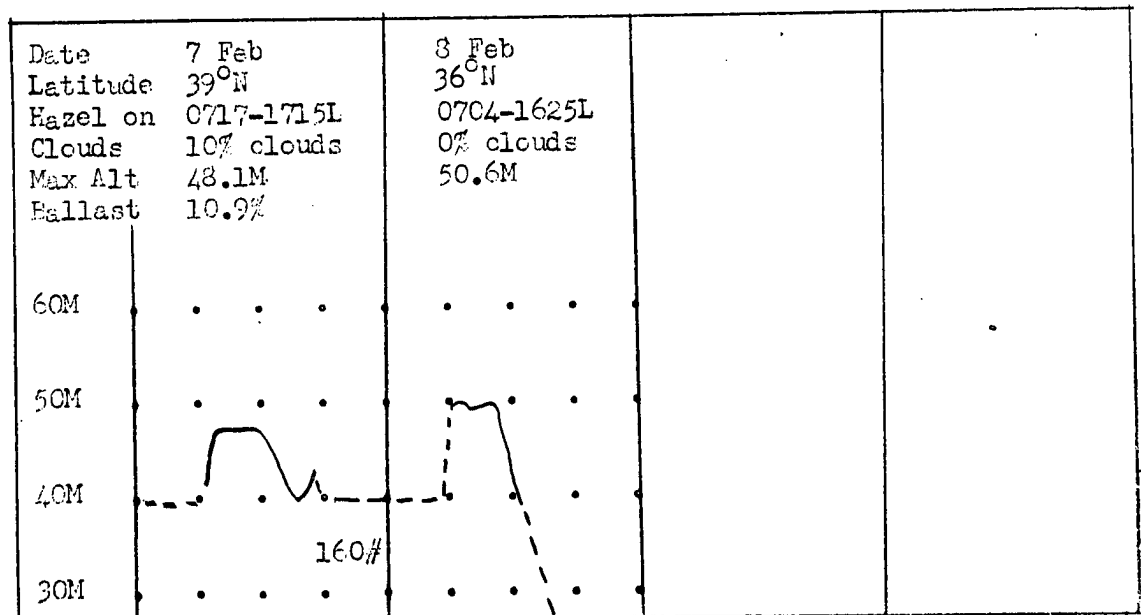
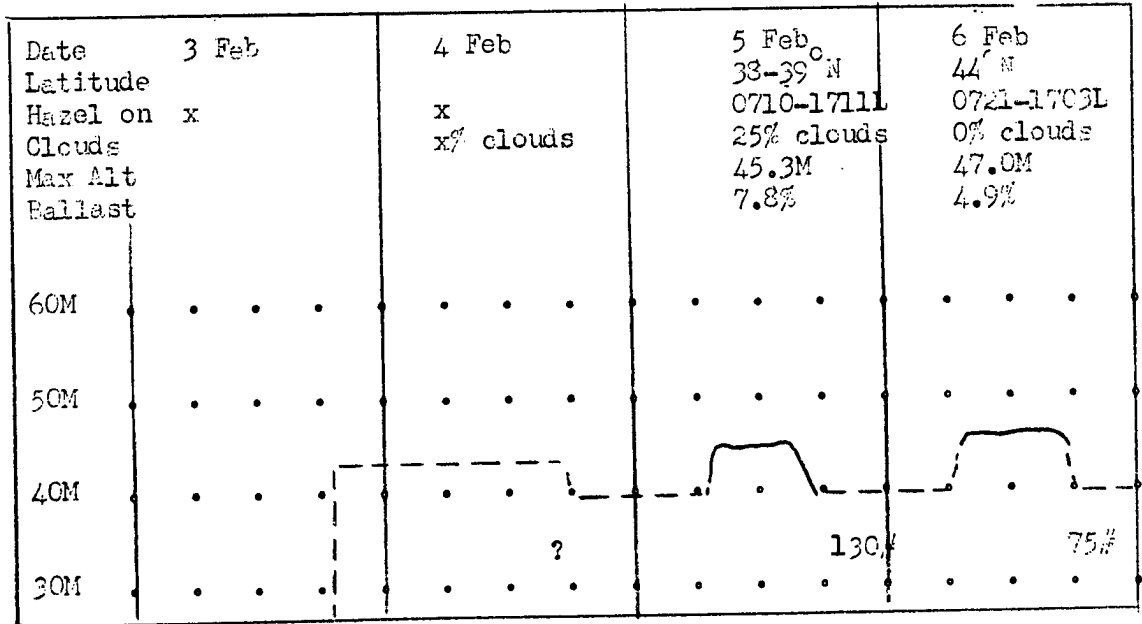
TOP SECRET

GIE-102

Type 66CT

Launched 03/1815Z Feb 1855L
 Terminated 08/0740Z Feb 1624L
 Enroute 109 hrs 25 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude 44.6M
 Base Altitude 40.0M



Incl 14

262

D-582

TOP SECRET

TOP SECRET

GIE-102 (Cont'd)

REMARKS:

1. The average daily ballast rate for this balloon was 7.9%. At this rate the balloon would have expired after a maximum of 6 days.
2. This balloon apparently self-terminated and was reported in the water at the time indicated above. Based on its ballasting history, it does not appear that lack of ballast would have caused its termination.
3. This balloon was launched at dusk and so should have stayed at its initial altitude until sunset of the 4th, when it should have ballasted. Since the balloons' initial altitude was certainly less than planned and probably less than measured (if it had ascended initially to 44.6M, it would have dropped only 55# or 3.2% of gross weight on the 4th), the first day's ballast cannot be even reasonably estimated.
4. On the 5th and 6th, the balloon travelled over a path that covered lowlands, hilly country and water surfaces. Its behavior was unexpectedly good considering this path.
5. On the 7th, the balloon travelled over desert areas through the morning and crossed into mountainous areas in the afternoon when it slowly descended to base altitude in the vicinity of 15.0M mountains.
6. On the 8th, the balloon began its rather abrupt descent about 1030L (0220Z) while over unfriendly territory; about 6 hours later it was reported in the water off South Korea.
7. If 50.6 were the balloon's maximum attainable altitude on the 8th and this seems to be so, the balloon had about 300# of ballast left at that time and should have lasted through two more ballasting periods.

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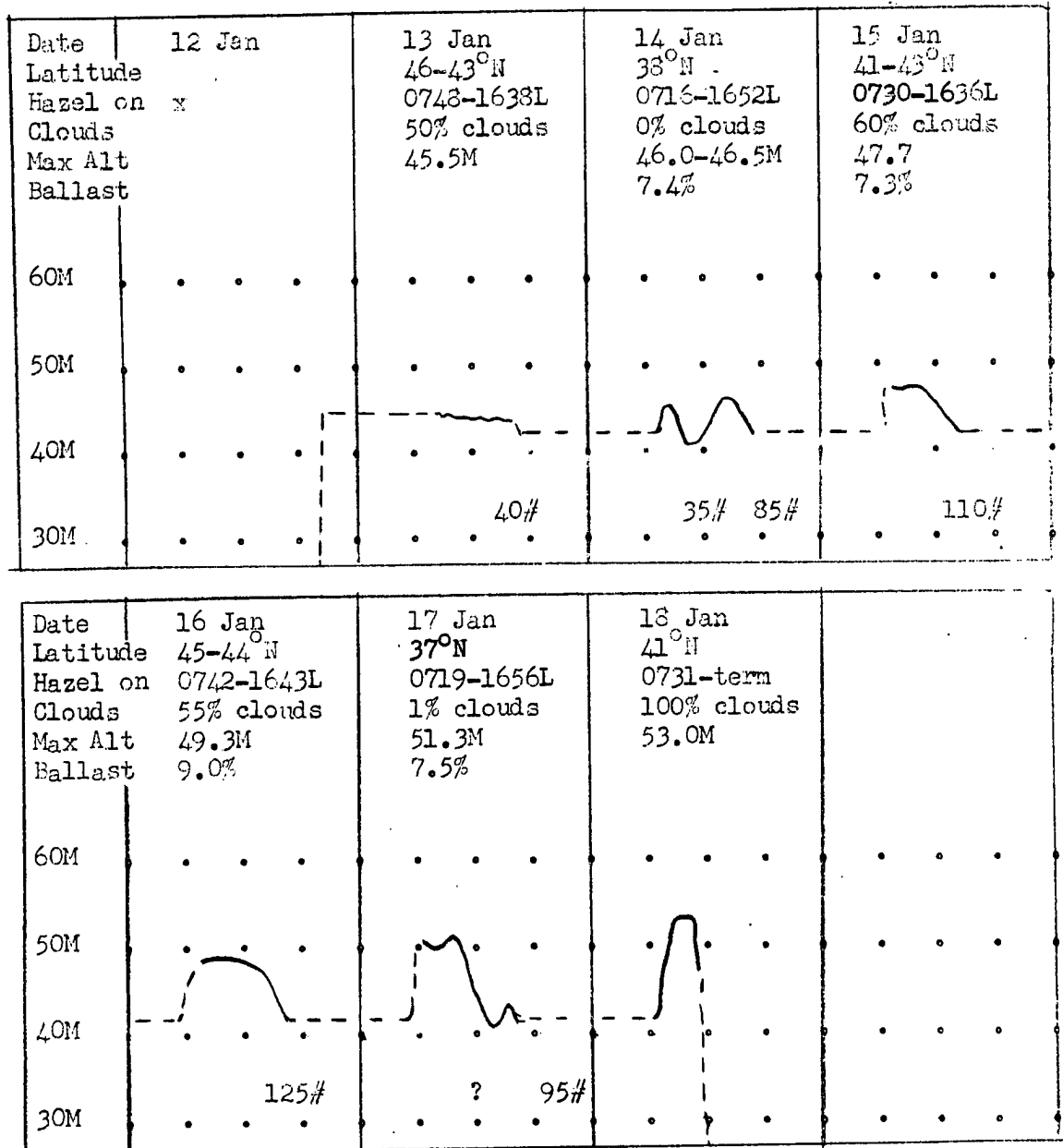
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OBE-8

Type 66CT

Launched 12/1902Z Jan 1942L
 Terminated 18/0216Z Jan 1132L
 Enroute 127 hrs 14 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude 45.0M
 Base Altitude 40.0M



Incl 15

264

D-582

TOP SECRET

TOP SECRET

REMARKS: (OBE-3 Cont'd)

1. The average daily ballast rate for this balloon was 7.8%. At this rate the balloon would have expired after a maximum of 6 days.
2. This balloon should not and probably did not ballast on the night of the 12th. Indications are that it did not reach its planned initial altitude.
3. Assuming that 45.5M was the initial altitude, then this balloon used 490# of ballast and had at most 165# left on the 18th. At 7%, it should have used 485# of ballast.
4. On the 13th, the balloon passed over lowlands and Black Sea; on the 14th, it passed over rough terrain descending to 41.0M shortly before noon when it probably ballasted.
5. On the 15th, it began to descend while over the Caspian Sea, and reached 41.0M (this seems to be base altitude on this balloon) about 1530L.
6. On the 16th, it was over 100% clouds through the morning and over 10% clouds during the afternoon. Travel was over mountains and valleys, it behaved rather well but ballasted rather heavily.
7. The balloon was over mountains again on the 17th, crossing a ridge - canyon complex about 1230L and began its descent arriving at 41.0M about 1400L.

TOP SECRET

CBE-55

Launched 25/2142Z Jan 2226L
Terminated 31/0604Z Jan 1544L
Enroute 128 hrs 22 min

Planned Initial Altitude	46.4M
Measured Initial Altitude	37.0M
Base Altitude	40.0M

266

D-582

TOP SECRET

TOP SECRET

OBE-55 (Cont'd)

REMARKS:

1. The average daily ballast rate for this balloon was 7.0%. At this rate the balloon would have expired after a maximum of 7 days.
2. Balloon was launched during darkness and so should have remained at initial altitude through the night of the 25th. Note that the measured initial altitude is given as 37.0M, which is quite low and probably incorrect. The balloon appears to have been rising on the morning of the 26th so that a reconstruction of the first night's flight is impossible. In any case, the balloon appears to have leveled off too low.
3. On the 26th, balloon crossed mountains during the morning and descended steadily reaching base about 1300L and apparently ballasting at that time. Balloon again showed steady descent on the 27th, hazel plots indicate it was crossing Black Sea during the morning, beginning descent about 1½ hours before reaching coastline. Balloon apparently ballasted about 1300L. Balloon was crossing lowlands and rolling hills on the 28th and 29th.
4. Balloon used at least 330# of ballast during the 26th, 27th, and 28th and had at most 365# left as it entered the 29th.
5. Apparently there was no photography on 30th and 31st.

267

D-582

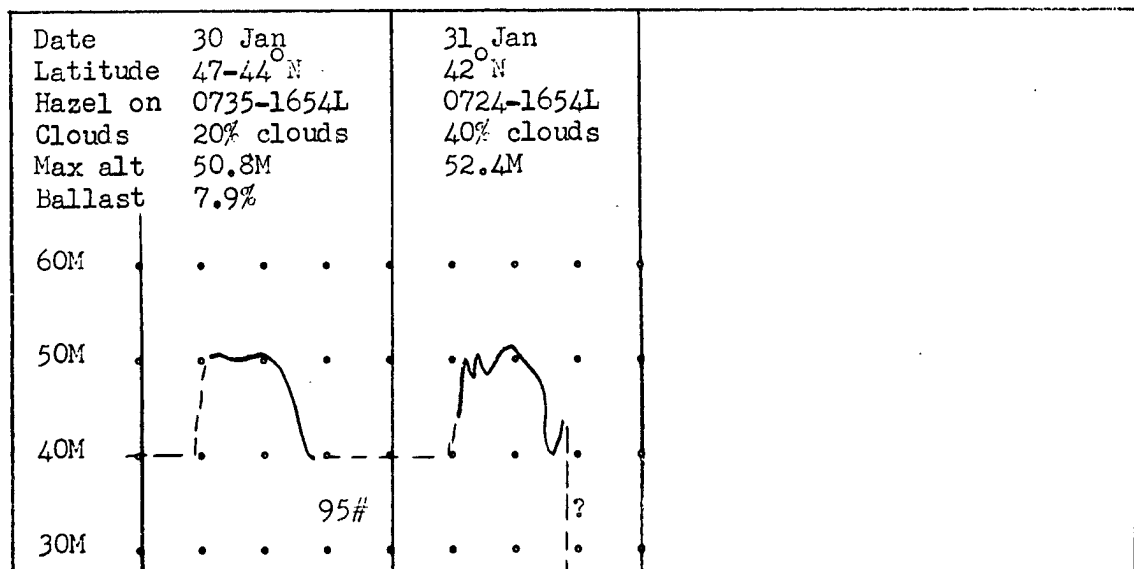
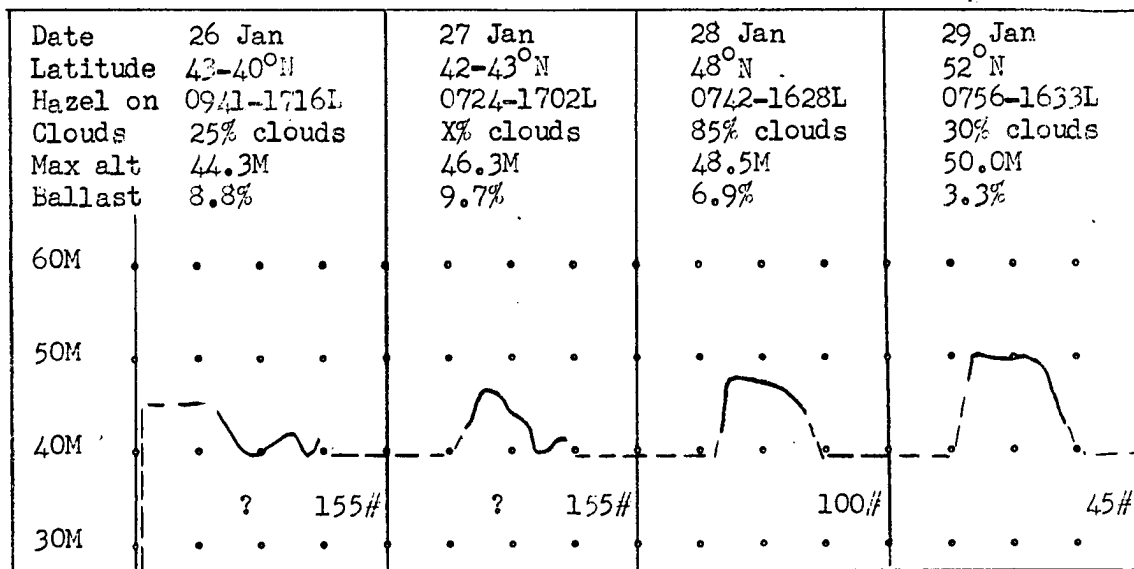
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OBE-57

Type 66CT

Launched 25/2317Z Jan 26/0001L Planned Initial Altitude 46.4M
 Terminated 31/0738Z Jan 1702L Measured Initial Altitude 42.9M
 Enroute 128 hrs 21 min Base Altitude 40.0M



Incl 17

268

D-582

TOP SECRET

TOP SECRET

REMARKS: (CBE-57 Cont'd)

1. The average daily ballast rate for this balloon was 7.3%. At this rate the balloon would have expired after a maximum of 7 days.
2. Balloon launched at night and should not have descended from initial altitude. Balloon may have descended a little during the night since it steadily descended from the time hazel activated on the 26th. However, since 44.3M seems reasonable, will assume that it is initial altitude.
3. On 26th, balloon steadily descended to base altitude while traversing over mountainous Balkans and apparently ballasted just before noon local time. On the 27th, crossed the Black Sea and slowly descended, reaching base in the early afternoon and ballasted. The balloon crossed lowlands and hills on the 28th through the 30th and behaved rather well. On the 31st, balloon presents turbulent looking profile fluctuating several thousand feet in altitude just about the time (0830L) that the balloon left the coast and entered over the Sea of Japan, finally descending to base altitude about 1530L and ballasted.
4. This balloon apparently lost 550# of ballast through the 30th and had at most 200# left as it entered the 31st.

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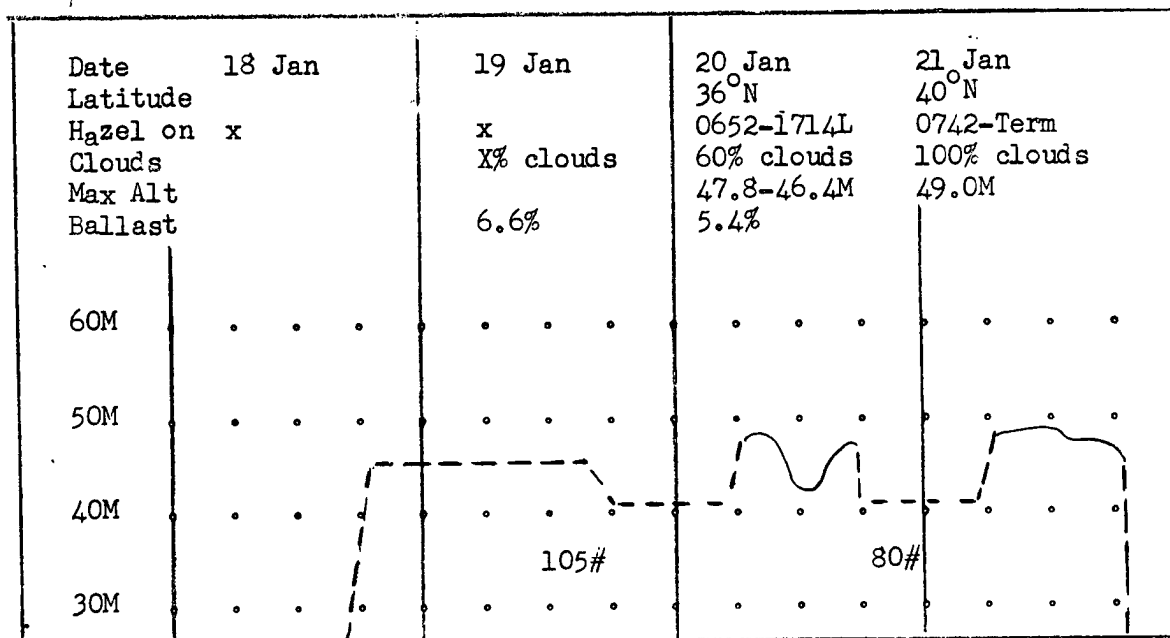
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ADA-29

Type 66CT

Launched 18/1437Z Jan 1701L
 Terminated 21/1009Z Jan 1941L
 Enroute 67 hrs 32 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M



REMARKS:

1. The average daily ballast rate for this balloon was 6.0%. At this rate the balloon would have expired after a maximum of 7 days.
2. This balloon probably did not descend during the night of the 18th, and had its first ballasting period at sunset of the 19th.
3. On the 20th it passed over mountains with peaks to 20.0-23.0M, the associated turbulence may have caused its descent to 41.0M about 1300L.
4. This balloon used at least 185# of ballast and had at most 405# left. At 7% it would have used 215#.

Incl 18

270

D-582

TOP SECRET

TOP SECRET

ADA-34

Type 6501

Launched 18/2006Z Jan 2230L
 Terminated Unk
 Enroute Unk

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	18 Jan	19 Jan	20 Jan	21 Jan
Latitude		34°N	34°N	36°N
Hazel on	x	1412-1713L	0659-1704L	0722-1649L
Clouds		0% clouds	30% clouds	10% clouds
Max Alt		40.6M	49.2M	52.5M
Ballast		11.9%	14.3%	
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 13.1%. At this rate the balloon would have expired after a maximum of 4 days.
2. Apparently this was a self-terminated balloon and its termination was due, probably, to lack of ballast during the evening of the 21st.
3. The balloon was at its base altitude, which appears to have been at 40.5M for this balloon, when the hazel unit activated. Hence lacking an indication of its initial altitude, will assume it to be at 46.4M, which appears reasonable in this case.
4. On the 19th, the balloon was over a rather mountainous area. However, there is no way of correlating the topography with the balloon descent prior to the hazel activation.
5. On the 20th, the balloon was again over mountains. It crossed a 15.0M range about 0800L, then entered over an area with hills from 2.0M to 9.0M for several hours, and descended to its base about noon over a 22.0M peak and probably ballasted at that time.
6. This balloon had at most 195# of ballast left on the 21st; which might have been enough to last it through that night but probably did not since the last geographical plot on this balloon was about 600 miles from where it was found.

Incl 19

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D-582

TOP SECRET

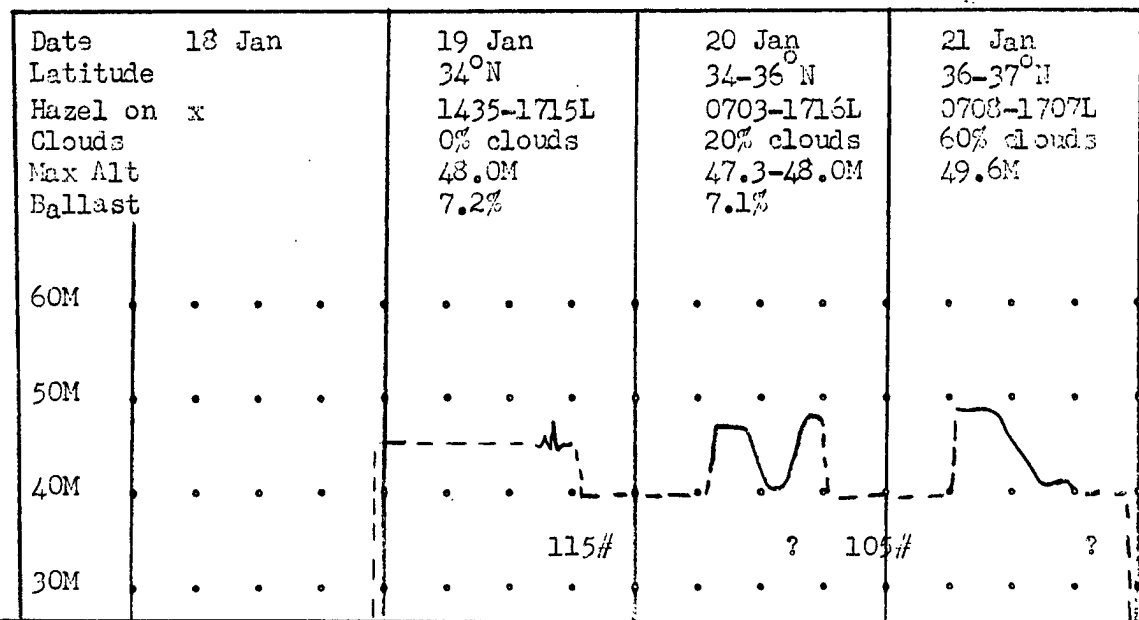
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ADA-36

Type 66CT

Launched 18/2122Z Jan 2346L
 Terminated 21/1414Z Jan 2338L
 Enroute 64 hrs 52 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M



REMARKS:

1. The average daily ballast rate for this balloon was 7.2%. At this rate the balloon would have expired after a maximum of 7 days.
2. This balloon had a rather erratic altitude plot on the 19th. The initial altitude was assumed to be 46.4M.
3. Ballasting on the 19th and 20th could be as shown above, probably ballasting 115# at sunset of 19th and none during the day of 20th; or it could have ballasted 65# on the 19th and an additional 50# during the day on the 20th.
4. On the 20th it crossed high mountains and experienced strong winds (90-144 knots) in region where the balloon descended, it was probably turbulent. It descended to 40.3M and may have ballasted.
5. The ballast consumption on the 21st cannot be computed. Through the night of the 20th, it had used at least 220# with at most 365# left.
6. At 7%, it would have used 215# through night of 20th.

Incl 20

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D-582

TOP SECRET

TOP SECRET

ADA-40

Type 66CT

Launched 19/1112Z Jan 1336L
 Terminated 22/1025Z Jan 1921L
 Enroute 71 hrs 13 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	19 Jan	20 Jan	21 Jan	22 Jan
Latitude		32°N	34-33°N	36°N
Hazel on	x	0711-1713L	0703L-1138Z	x
Clouds		30% clouds	2% clouds	
Max Alt		46.4M	48.7M-49.5M	51.0M
Ballast		10.2%	10.1%	
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 10.2%. At this rate the balloon would have expired after a maximum of 5 days.
2. The balloon should have ballasted night of 19th. If balloon reached maximum attainable altitude on the 20th either did not ballast on 19th or the balloon had more initial gross than planned.
3. On 20th, over lowlands and river valleys. Descended to 40.3M about 1330L, may have ballasted at that time.
4. On 21st, travelled over mountains and descended to base altitude about 1330L where it ballasted.
5. Apparently used 305# of ballast on nights of 20th and 21st. Had at most 280# of ballast left as of day of 22d.

Incl 21

273

D-582

TOP SECRET

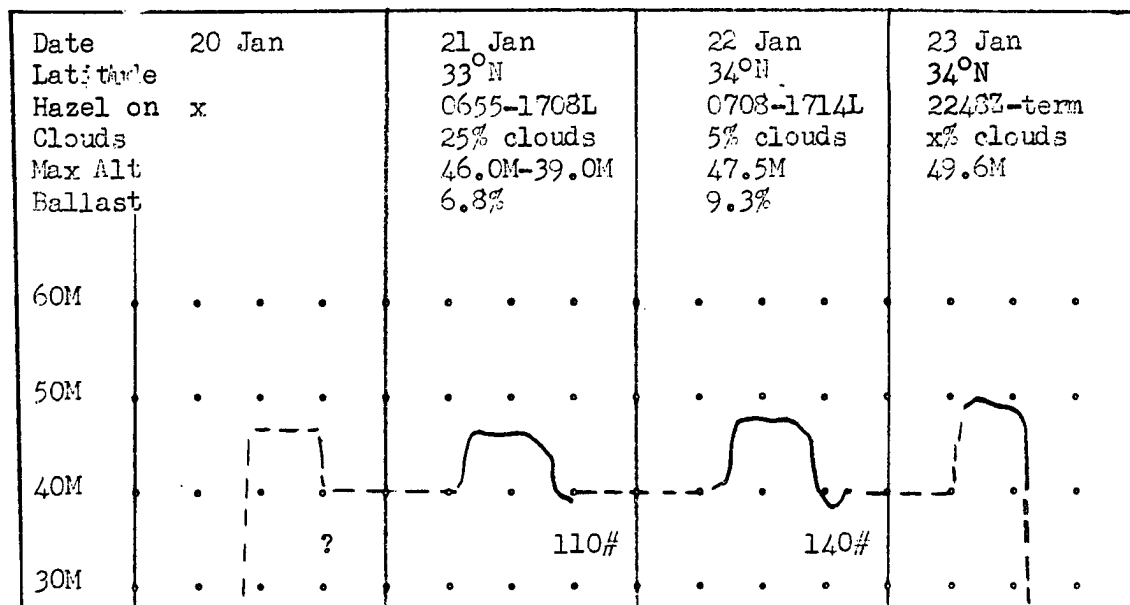
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ADA-48

Type 66CT

Launched 20/0728Z Jan 0952L
 Terminated 23/0334Z Jan 1230L
 Enroute 68 hrs 06 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M



REMARKS:

1. The average daily ballast rate for this balloon was 3.0%. At this rate the balloon would have expired after a maximum of 6 days.
2. This balloon should have ballasted on the night of the 20th. Either it did not or the balloon had more gross weight than planned.
3. On the 21st and 22d it used 250# of ballast at least, and had at most 365# left.
4. At 7% with the proper gross weight for an initial altitude of 46.4M, it should have used 310# of ballast.
5. On both the 21st and 22d, the balloon crossed ridges in the late afternoon. This may have accelerated its descent and caused under-shooting of the base altitude on those dates, or the aneroid controlling the base altitude may have been set too low.

Incl 22

274

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ADA-52

Type 660T

Launched 21/0228Z Jan 0452L
 Terminated 23/1710Z Jan 24/0150L
 Enroute 62 hrs 42 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	21 Jan	22 Jan	23 Jan	24 Jan
Latitude		34-36°N	36-33°N	
Hazel on	x	0709-1656L	0707-1706L	Term
Clouds		1% clouds	5% clouds	
Max Alt		46.0M	43.0M	
Ballast		9.0%		
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 9.0%. At this rate the balloon would have expired after a maximum of 5 days.
2. This balloon should have ballasted on the night of the 21st. Either it did not do so, or it grossed more weight than planned.
3. If the balloon ballasted on the night of the 21st, cannot estimate amount.
4. On the night of the 22d, the balloon ballasted 145#, at 7% it would have ballasted 113#. As of the night of the 22d, the balloon had at most 470# of ballast left.
5. On the 23d, the balloon travelled over rather high mountains with peaks to as high as 28.5M. Turbulence in these mountains may have caused the balloon's descent to 40.7M about 1400L. Ballasting may have occurred at this time.

Incl 23

275

D-582

TOP SECRET

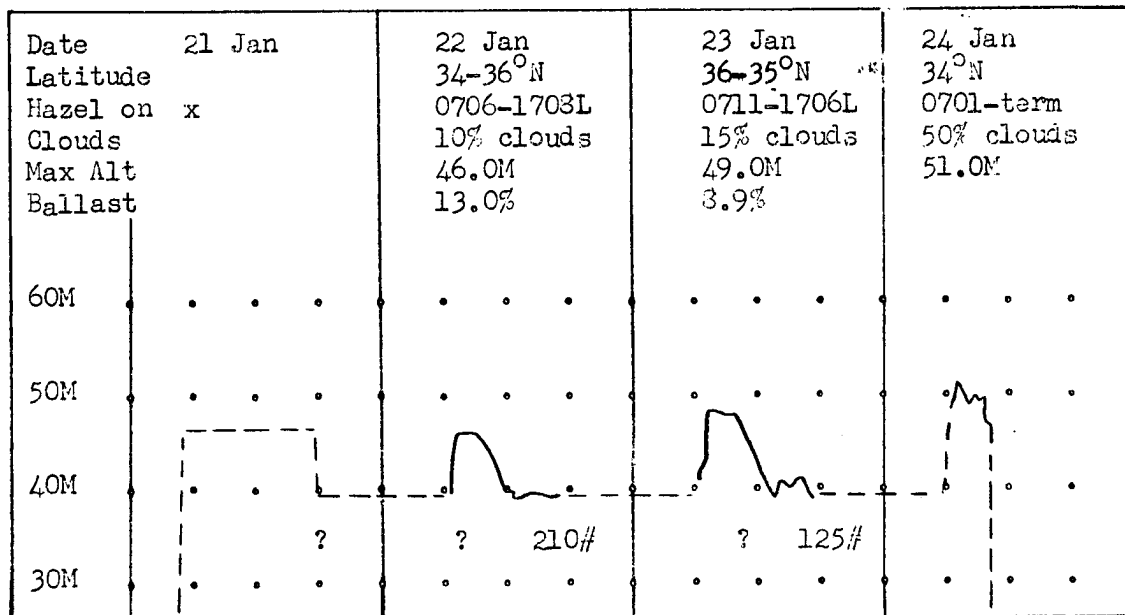
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ADA-54

Type 66CT

Launched 21/0145Z Jan 0409L
 Terminated 24/0123Z Jan 1035L
 Enroute 71 hrs 38 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M



REMARKS:

1. The average daily ballast rate for this balloon was 11.0%. At this rate the balloon would have expired after a maximum of 4 days.
2. This balloon should have ballasted on the night of the 21st. Apparently the gross weight was more than required for an initial altitude of 46.4M. Not knowing the initial altitude, cannot compute the ballast used on the 21st.
3. Assuming that 46.0M was the maximum altitude attainable on the 22d, then 210% of ballast was used in maintaining the base altitude through that afternoon and at sunset. The balloon travelled over mountains from about 0900L which increased in height throughout the day with peaks increasing from 12.0 to 20.0M as the day passed. On the 23d the balloon travelled over high mountains all day, following essentially the same ballasting cycle.
4. This balloon used at least 335% of ballast and had 230% at most left.
5. At 7% with gross weight for an initial altitude 46.4M, it should have used 215% of ballast in two periods, or 310% in three periods.

Incl 24

276

D-582

TOP SECRET

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ADA-56

Type 660T

Launched 21/1253Z Jan 1517L
 Terminated 23/1627Z Jan 24/0131L
 Enroute 51 hrs 34 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	21 Jan	22 Jan	23 Jan	24 Jan
Latitude		31°N	31°N	
Hazel on	x	0745-1743L	0706-Term	Term
Clouds		10% clouds	15% clouds	
Max Alt		44.6M-45.4M	47.1M	
Ballast		11.0%		
60M	• • • •	• • • •	• • • •	• • • •
50M	• • • •	• • • •	• • • •	• • • •
40M	• • • •	• • • •	• • • •	• • • •
30M	• • • •	• • • •	• • • •	• • • •

Hand-drawn altitude profile on the 40M line:
 - 21 Jan: A dashed line descends from 40M to 30M, marked with a question mark (?).
 - 22 Jan: A solid line starts at 40M, dips slightly, then rises to 45.4M, marked with 65# and 125#.
 - 23 Jan: A solid line starts at 47.1M and descends steadily to 40M, marked with a question mark (?).
 - 24 Jan: A dashed line descends from 40M to 30M.

REMARKS:

1. The average daily ballast rate for this balloon was 11.0%. At this rate the balloon would have expired after a maximum of 4 days.
2. Balloon should have ballasted night of 21st. Either did not, was loaded too heavy, or balloon did not attain maximum altitude.
3. Assuming 44.6M was maximum altitude attainable on morning of 22d, 190# of ballast were used on the 22d. On the 22d, balloon was travelling over desert, began descent just after entering hilly country reaching base altitude and apparently ballasted about 1500L.
4. On 23d balloon travelled over mountains 12.0M-14.0M, descended steadily to base and probably ballasted about 1300L.
5. Balloon had at most 535# of ballast entering the 23d.

Incl 25

277

D-582

TOP SECRET

TOP SECRET

ADA-58

Type 66CT

Launched 21/1727Z Jan 1951L
 Terminated 23/2213Z Jan 24/0737L
 Enroute 52 hrs 46 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	21 Jan	22 Jan	23 Jan	24 Jan
Latitude		32° N		
Hazel on	x	1234-1615L	22/2320Z-0818Z	0716-term
Clouds		0% clouds	x% clouds	x% clouds
Max Alt		45.0M	48.3-49.4M	50.5M
Ballast		14.2%	9.7%	
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 12.0%. At this rate the balloon would have expired after a maximum of 4 days.
2. This balloon should have stayed at its initial altitude through the night of the 21st. The balloon may have reached 46.4M and descended to 45.0M, or 45.0M may have been its initial altitude. Will assume the latter.
3. On the 22d the balloon apparently ballasted about 1430L after passing a 9.0M ridge perpendicular to the flight path. Cannot compute the amount used since sunset caught the balloon while still ascending.
4. On the 23d it apparently ballasted shortly after noon. Cannot correlate with orography due to equipment malfunction. It used at least 70# in daylight ballast and at least that much at sunset - probably more since balloon terminated while still ascending on the 24th.
5. Through the night of the 23d, this balloon used at least 380# of ballast and had at most 310# left.
6. At 7% with gross for 46.4M initial altitude, a balloon would have used 215# (or 230# at gross for 45.0M).

Incl 26

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TOP SECRET

ADA-60

Type 66CT

Launched 21/1833Z Jan 2057L
 Terminated 24/0003Z Jan 0923L
 Enroute 53 hrs 30 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	21 Jan	22 Jan	23 Jan	24 Jan
Latitude		32°N	34-35°N	31°N
Hazel on	x	1328-1720L	0648-1646L	0645-term
Clouds		5% clouds	20% clouds	30% clouds
Max Alt		44.4M	48.0M	50.0M
Ballast		7.2%	8.8%	
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

115# ? 130#

REMARKS:

1. The average daily ballast rate for this balloon was 8.0%. At this rate the balloon would have expired after a maximum of 6 days.
2. The balloon should not have ballasted on the night of the 21st and did not do so.
3. On the 22d, the balloon was descending when hazel activated, hence the maximum altitude is not known. Will assume the maximum altitude to be the planned initial altitude of 46.4M. The balloon flight was over hilly country. The balloon reached its base altitude about 1600L.
4. On the 23d, the balloon flight was over mountains with peaks to 20.0-22.0M. About an hour before beginning its descent, the balloon passed over a 21.3M ridge oriented perpendicular to its path. The ground speed of the balloon was 100 knots just before its descent. The balloon apparently ballasted about 1300L. This was a good situation for a mountain wave.
5. The balloon used 245# of ballast and had at most 335# left on the 24th.
6. At 7%, 215# of ballast would have been used in two periods.

Incl 27

279

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TOP SECRET

TOP SECRET

ADA-61

Type 66CT

Launched 22/0900Z Jan 1124L
 Terminated 24/1314Z Jan 2154L
 Enroute 52 hrs 14 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	22 Jan	23 Jan	24 Jan	
Latitude		35°N	31°N	
Hazel on x		0321-1707L	0651-1717L	
Clouds		3% clouds	5% clouds	
Max Alt		46.8M	49.6M-50.1M	
Ballast		12.2%		
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 12.2%. At this rate the balloon would have expired after a maximum of 4 days.
2. Balloon was launched in daylight and so should have ballasted at sunset of the 22d. Apparently the initial altitude was lower than planned but cannot say what it was.
3. Balloon travelled over lowlands through the morning of the 23d; about 1300L it entered over 5.0M mountains and within an hour had descended to 41.0M, where it may have ballasted. It traversed progressively higher mountain regions thereafter with one range having 25.0M peaks.
4. On the 24th, was over mountains in the morning and was being carried by winds of 170 knots. About 1100L crossed a 20.0M ft range and had reached base about 1330L where it apparently ballasted. During the time the balloon was at about 41.0M its speed reached 198 knots.
5. Just as it was approaching sunset of the 24th, the balloon had at most 335# of ballast left and had used at least 220#.

Incl 28

280

D-582

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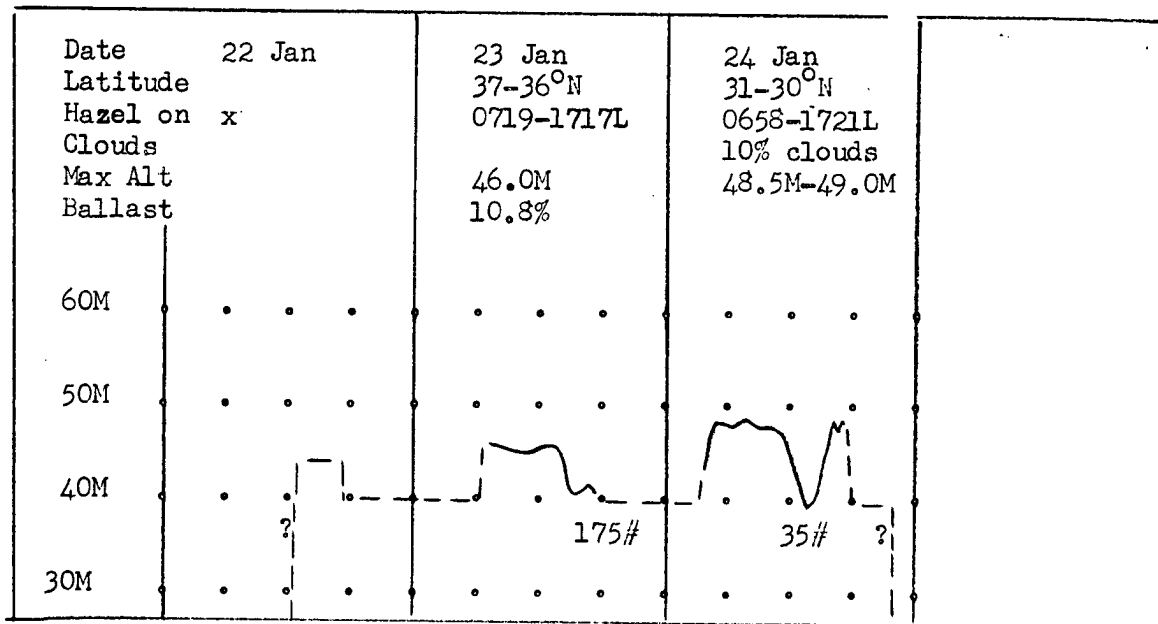
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ADA-62

Type 66CT

Launched 22/0942Z Jan 1206L
 Terminated 24/1304Z Jan 2144L
 Enroute 51 hrs 22 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M



REMARKS:

1. The average daily ballast rate for this balloon was 10.8%. At this rate the balloon would have expired after a maximum of 5 days.
2. Balloon should have ballasted on the night of the 22d. If it did and 46.0M is the maximum altitude attainable on the 23d, then the balloon weighed more than planned when launched.
3. On the 23d, balloon passed over plains during the morning and entered hilly country about noon. The balloon crossed several isolated peaks and a ridge about an hour before it descended rather abruptly to very near the base altitude. It may have ballasted about 1500L.
4. On the 24th, the balloon travelled over mountainous terrain with peaks to 25.0M in the morning. The abrupt descent about noon local time was apparently on the lee side of these mountains. Thereafter the balloon was in lowland areas.
5. If 46.0M was the maximum altitude attainable on the 23d, then this balloon used at least 175# of ballast that night. An additional minimum of 35# was used the afternoon of the 24th and the balloon had at most 405# of ballast left entering the night of the 24th.

Incl 29

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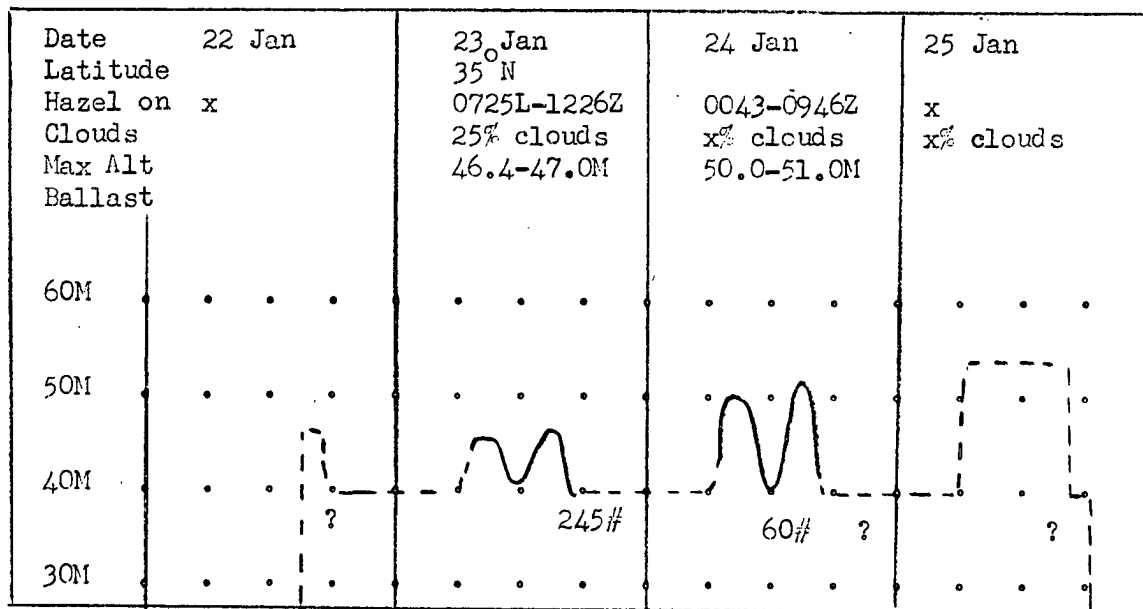
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ADA-66

Type 66CT

Launched 22/1256Z Jan 1520L
 Terminated 25/0800Z Jan 1644L
 Enroute 67 hrs 04 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M



REMARKS:

1. The average daily ballast rate for this balloon was 7.9%. At this rate the balloon would have expired after a maximum of 6 days.
2. This balloon should have ballasted on the night of the 22d. It leveled off at 46.4M on the morning of the 23d, hence have no way of knowing what amount was used on the 22d. It probably did not reach its maximum altitude on the 23d, so part of the 245# shown on the 23d was actually used on the previous night.
3. As of the afternoon of the 23d, 305# of ballast were used and the balloon had at most 280# left. In two ballasting periods, the balloon should have used 215# at 7%.
4. Assuming the balloon did not reach its maximum possible altitude on the 23d and that the balloon ballasted at the same rate on the nights of 22d and 23d, the 245# shown above would be spread over those nights. The ballast rate under these assumptions, would be 7.9%.
5. The equipment malfunctioned after about one hour on 23d, so cannot discuss possible effects of topography on midday descents of the balloon on the 23d and 24th.

Incl 30

282

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TOP SECRET

TOP SECRET

ADA-67

Type 66CT

Launched 22/1806Z Jan 2030L
 Terminated 24/2006Z Jan 25/0446L
 Enroute 50 hrs 00 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	22 Jan	23 Jan	24 Jan	25 Jan
Latitude		36-37°N	37-33°N	
Hazel on x		0722-1704	0702-1650	Term.
Clouds		40%	5% clouds	
Max Alt		4517M-48.5M		
Ballast		12.2%		
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 12.2%. At this rate the balloon would have expired after a maximum of 4 days.
2. This balloon was launched at night and so should have remained at its initial altitude through the night of the 22d and the morning of the 23d. On the 23d, the balloon was at 45.7M, so will assume this to be the initial altitude.
3. On the 23d, the balloon began descending about 1100L after passing over a water surface and ballasted about noon; thereafter ascending to 46.0M, indicating a ballast drop of 25# if this was the maximum attainable altitude at this time. A ballast expenditure of 175# was indicated during the night of the 24th.
4. On the 24th, the balloon was travelling over mountainous terrain with peaks to 19.0M. The balloon descended to and undershot its base about 1500L. After passing a snow capped ridge, the balloon descended from 46.0M to 39.4M in 31 minutes (about 210 ft/min average rate of descent).
5. Entering the 24th, the balloon had used 200# of ballast and had at most 440# left. It probably used a fairly large amount about 1500L on the 24th when it undershot its base, and it would have ballasted again at sunset on the 24th.

Incl 31

283

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TOP SECRET

TOP SECRET

ADA-69

Type 66CT

Launched 22/1923Z Jan 2147L
 Terminated 25/0220Z Jan 1104L
 Enroute 54 hrs 57 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	22 Jan	23 Jan	24 Jan	25 Jan
Latitude		37°N		
Hazel on	x	0756-1714L	0144Z-1029Z	Unk-term
Clouds		25% clouds	x clouds	x clouds
Max Alt		44.4-45.0M	47.0-48.0M	
Ballast		11.7%		
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 11.7%. At this rate the balloon would have expired after a maximum of 4 days.
2. The initial altitude was apparently 44.4M.
3. On the morning of 23d, the balloon crossed the Caspian Sea, it began to descend about an hour later, at 1300L when crossing 4.0-5.0M foothills. Apparently it ballasted more than the 55# shown since it was still ascending up to about half an hour before hazel off time.
4. On the 24th, cannot correlate with orography due to equipment malfunction, but apparently the balloon ballasted shortly after noon, using at least 70# (4.5%) of ballast and probably more since it was ascending at sunset.
5. At 7% with gross for 46.4M, it should have used 110# through the 23d. At same rate and time with gross for 44.4M, should have used 120#.
6. This balloon used at least 205# of ballast through night of the 23d and had at least 690# left.

Incl 32

284

D-582

TOP SECRET

TOP SECRET

ADA-77

Type 66CT

Launched 23/2017Z Jan 2241L
 Terminated 26/0450Z Jan 1338L
 Enroute 56 hrs 33 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	23 Jan	24 Jan	25 Jan	26 Jan
Latitude		35°N	43-40°N	33°N
Hazel on	x	0842-1710L	0734-1705L	0703-Term
Clouds		15% clouds	15% clouds	5% clouds
Max Alt		43.8M	45.8M	47.4-47.8M
Ballast		8.9%	7.0%	
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 3.0%. At this rate the balloon would have expired after a maximum of 6 days.
2. The balloon should have remained at its initial altitude through the night of the 23d. Apparently the initial altitude was lower than planned; will assume it to be 43.8M.
3. On the 24th, the balloon began to descend about 1500L, just about the time it was approaching foothills. The possible turbulence over 10.0M peaks plus normal sunset expenditure may account for the heavy rate on this date.
4. On the 26th, the balloon apparently ballasted about 1000L just about an hour after leaving the coast. The balloon lost at least 30% of ballast at this time and probably more since it was still ascending when it was terminated. This may have been either a thermal or mechanical effect at the continental boundary.
5. Through the night of the 25th, this balloon had used at least 275% of ballast with at most 515% left.
6. If the balloon had been grossed for 46.4M it should have used 215% at 7%. If gross were for 43.8M, should have used 245%.

Incl 33

285

D-582

TOP SECRET

TOP SECRET

ADA-85

Type 66CT

Launched 24/1143Z Jan 1407L
 Terminated 26/1705Z Jan 27/0141L
 Enroute 53 hrs 22 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	24 Jan	25 Jan	26 Jan	27 Jan
Latitude		33-37°N	39-34°N	
Hazel on	x	0706-1711L	0717-1719L	Term
Clouds		15% clouds	5% clouds	
Max Alt		45.7M-46.0M	48.3M	
Ballast		11.5%		
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 11.5%. At this rate the balloon would have expired after a maximum of 4 days.
2. The balloon launched during daylight and so should have ballasted at sunset of the 24th. Apparently the initial altitude was lower than planned.
3. On the 25th, was over 5.0M mountains when the Q-1 activated. About 0930L, passed over 21.0M mountains and then into terrain generally 5.0M. By 1130L had reached base altitude and ballasted, losing at least 25# of ballast. Ballasted again at sunset, having used a total of 190# of ballast on the 25th, having at most 450# left as it entered the 26th. Note that the balloon undershot its base.
4. On the 26th, the balloon was over mountains in the early morning, and entered over a desert area about 1100L and was approaching foothills about an hour later when it began to descend; reaching and under-shooting the base altitude about 1400L when it ballasted and probably lost quite a bit of ballast.
5. If the balloon continued to ballast at a daily rate of 11.5% of gross weight, the 450# of ballast would have lasted through the sunset of the 27th and the balloon probably would have died during its next ballast period on the 28th.

Incl 34

286

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TOP SECRET

TOP SECRET

ADA-88

Type 66CT

Launched 24/1532Z Jan 1756L
 Terminated 27/0427Z Jan 1315L
 Enroute 60 hrs 55 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 44.0M

Date	24 Jan	25 Jan	26 Jan	27 Jan
Latitude		33-35°N	41-39°N	32°N
Hazel on	x	0705-1712L	0723-1713L	0708-term
Clouds		20% clouds	20% clouds	30% clouds
Max Alt		45.0M	47.0-47.5M	48.5M
Ballast		8.8%	6.5%	
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 7.6%. At this rate the balloon would have expired after a maximum of 6 days.
2. This balloon should have stayed at its initial floating altitude until sunset, on the 25th.
3. Difficult to say what initial altitude was; if it was 45.0M, then gross weight was more than planned. It may also have overshot initial altitude and lost gas, then settled to a lower floating altitude than planned for the first night. This latter explanation would help account for the high ballast rate shown for the 25th.
4. Assuming an initial altitude of 45.0M and a gross weight of 1695#, the balloon used 350# of ballast and had at most 440# left.
5. At 7% and with proper gross weight, it would have used 215# of ballast.
6. This balloon appears to have ballasted during the day on both the 25th and 26th. On both days it came off a fairly level desert type area, then over a ridge and descended on the lee side, due either to turbulence or changed radiation effects.

Incl 35

287

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TOP SECRET

A A-89

Type 66CT

Launched 24/2100Z Jan 2324L
 Terminated 27/0730Z Jan 1646L
 Enroute 58 hrs 30 min

Planned Initial Altitude 46.4M
 Measured Initial Altitude None
 Base Altitude 40.0M

Date	24 Jan	25 Jan	26 Jan	27 Jan
Latitude		34-33°N	37-41°N	36-34°N
Hazel on		0918-1709L	0705-1646L	0704-1615L
Clouds		50% clouds	15% clouds	10% clouds
Max Alt		45.5M	48.0M	49.7M
Ballast		11.1%	7.5%	
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 9.3%. At this rate the balloon would have expired after a maximum of 5 days.
2. This balloon was launched at night and so should have stayed at its initial altitude through the night of the 24th. However, the balloon was apparently descending when the Q-1 activated on the 25th and hence the initial altitude cannot be determined; the balloon later reached a maximum altitude of 45.5M after nearly reaching its base, so 45.5M may have been initial altitude. If so, the balloon used 295# of ballast in two days and had at most 360# left on the 27th.
3. If the initial altitude was as planned at 46.4M it used at least 225# of ballast and had at most 360# left.
4. The balloons flight on the 25th carried it over a series of hills and valleys, during which it descended to 40.2M about 1000L and to 40.0M about 1500L. It may have ballasted about 1000L and probably did so at 1500L. This, of course, supports the heavier of the ballast expenditures on the 25th.
5. Balloon crossed mountains on the 26th, began descent about 0900L reaching 40.4M about 1100L and may have ballasted.
6. On the 27th, began descending about an hour after leaving the coast and arrived at 40.4M about 1400L.

Incl 26

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TOP SECRET

TOP SECRET

ADA-91

Type 66CT

Launched 25/1200Z Jan 1424L

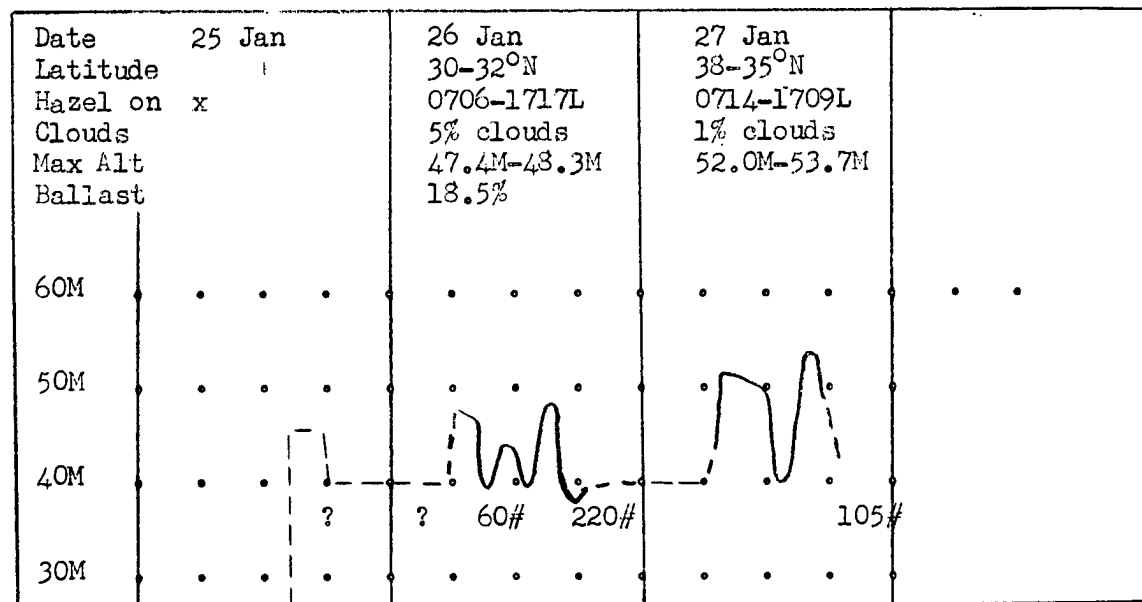
Planned Initial Altitude 46.4M

Terminated Unk Unk

Measured Initial Altitude None

Enroute Unk

Base Altitude 40.0M



REMARKS:

1. The average daily ballast rate for this balloon was 18.5%. At this rate the balloon would have expired after a maximum of 3 days.
2. This balloon was self-terminated, probably came down during the night of the 27th; and considering the ballasting rate, the termination was probably due to lack of ballast.
3. The balloon was launched in the afternoon, and so should have ballasted the night of the 25th. Lacking precise information on the initial altitude makes an exact reconstruction impossible. However, if 46.4M was the initial altitude, then balloon used 75# of ballast to get to an attainable altitude of 47.4M; or more probably, some of the 280# of ballast shown as dropped on the 26th was used on the 25th.
4. As this balloon approached sunset of the 27th, it had at most 125# of ballast left. At the rate this balloon had been ballasting, this was probably not enough even if there were that much aboard.
5. This balloon apparently ballasted twice during daylight on the 26th: once after passing over a water surface and again on the lee slopes of a 10.0M mountain range. The balloon undershot its base by 1000ft when it descended for the night.
6. Balloon ballasted about noon on the 27th after passing an 8.0M mountain range.

Incl 37

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TOP SECRET

ADA-142

Type 66CT

Launched 03/1159Z Feb 1423L
 Terminated 06/0712Z Feb 1552L
 Enroute 67 hrs 13 min

Planned Initial Altitude 49.0M
 Measured Initial Altitude None
 Base Altitude 44.0M

Date	03 Feb	04 Feb	05 Feb	06 Feb
Latitude		37-34°N	32-53°N	36-35°N
Hazel on		0705-1722L	0656L-1109Z	0659L-term
Clouds		2% clouds	30% clouds	0% clouds
Max Alt		48.0M	50.5M	52.0M
Ballast		10.8%	6.8%	
60M	.	.	.	.
50M	.	.	.	.
40M	.	.	.	.
30M	.	.	.	.

REMARKS:

1. The average daily ballast rate for this balloon was 3.3%. At this rate the balloon would have expired after a maximum of 6 days.
2. Should have ballasted night of 3d. Since maximum altitude on 4th is less than planned altitude, cannot estimate what initial altitude might have been if gross weight were more than planned.
3. Base altitude should have been 44.0M; balloon base actually appears to have been 43.5M, maybe attributable to functioning of auxiliary ballast control.
4. On the 4th, over Caspian Sea first hour, then over foothills and desert.
5. On the 5th, over mountains 15.0M-24.0M in morning. Descended to base about 1300L.
6. On the 6th, began over land then over Yellow Sea about 1000L, began descent shortly thereafter and descended to base altitude about 1400L.
7. Apparently lost at least 250# of ballast and had at most 220# left after ballasting on the night of the 5th.

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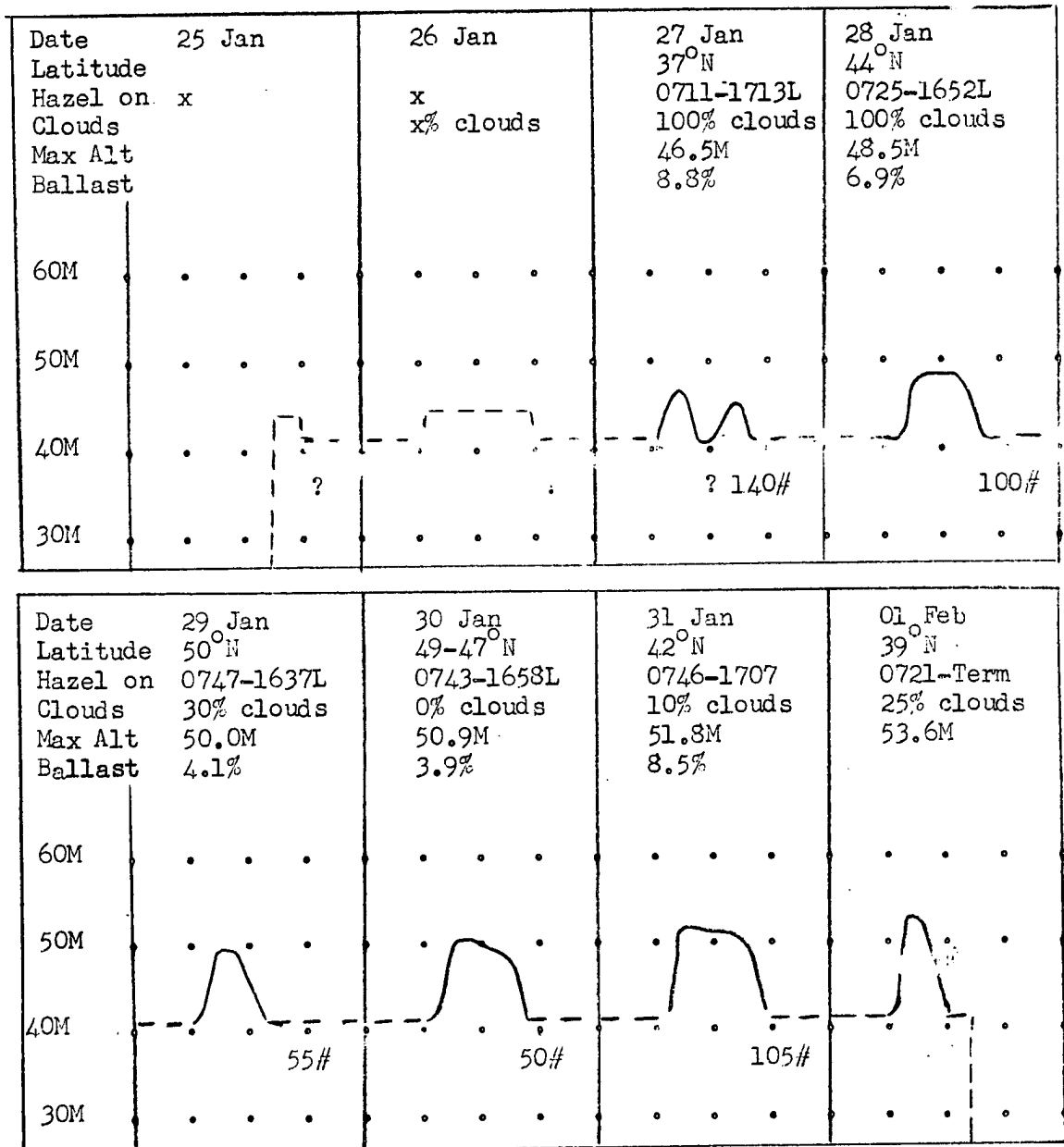
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EVA-50

Type 66CT

Launched 25/1513Z Jan 1457L
 Terminated 01/0537Z Feb 1453L
 Enroute 158 hrs 22 min

Planned Initial Altitude 45.3M
 Measured Initial Altitude 42.3M
 Base Altitude 40.0M



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REMARKS: EVA-50 Cont'd

1. The average daily ballast rate for this balloon was 6.4%. At this rate the balloon would have expired after a maximum of 9 days.
2. The balloon launched during daylight and should have ballasted on the 25th and again on the 26th. Neither the planned nor the measured initial altitudes appear reasonable, the actual initial altitude was probably somewhere between the two. If the balloon had first floated at 45.3M, it would have used only 90# of ballast on these two nights; and if it floated initially at 42.3M, it would have used 350# of ballast during that period. This latter figure may not be too bad considering that the balloon appears to level off at 41.0M rather than 40.0M so that the base might be higher than planned. Hence there would have been very little (1300 ft initially) between the two altitudes and the balloon would have used considerable ballast.
3. Otherwise, the balloon used 450# of ballast in 5 days and had at most 130# left on the morning of 1 Feb.
4. The balloon was well behaved most of the way. It probably ballasted about noon on the 27th, the positions were computed from hazel data only so a good correlation with orography cannot be made. It was over mountains at the time. On the 29th the balloon began its days' travel over lowlands and began its descent early as it approached foothills.

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TAB O

MATERIEL

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I. MATERIEL SUPPORT OF MOBY DICK HI

A. Upon activation of the 1st Air Division, 15 April 1955, it was determined that minimum materiel manning would be adequate to support the primary mission. At that time the mission of the directorate was to monitor only the materiel actions and requirements of the 6926th Radio Squadron (Mobile), the 456th Troop Carrier Wing and the 1110th Air Support Group units during the training phases of Moby Dick Hi and the preparation for overseas deployment. (S)

B. During May 1955 it became apparent that to adequately support the materiel aspects of our assigned mission, it was imperative that the 1st Air Division immediately assume all materiel and logistical command responsibility for the 456th and 1110th units until such time as they deployed overseas. With the concurrence of Headquarters Command and the Tactical Air Command such command responsibility was assumed by this headquarters 6 June 1955 with no increase in assigned personnel. (S)

C. With Project Grand Union (119L) procurement centralized at Headquarters Air Materiel Command, storage centralized at Middletown Air Materiel Area and Moby Dick Hi training being conducted at Charleston and Lowry Air Force Bases, the activities and areas to be directed or monitored by the directorate fell into several clearly defined areas; i.e., procurement and deliveries of Grand Union materials, storage and special packaging of these items, support of all CONUS training and the preparation for overseas movement inspections of the 456th and 1110th units. The extent and nature of these areas of activity follows: (S)

1. Grand Union Bill of Materials. A listing titled "Grand Union Bill of Materials" was developed by Air Force Cambridge Research Center and Air Materiel Command as a printed classified listing of all project procurements necessary to support in Section I, the launching site equipments, Section II, balloon equipment and in Section III, the C-119 aircraft equipments, both for airframe installation and spares. Through constant revision and subsequent dissemination to all interested activities, this listing served as a guide for monitoring receipts, enroute shipments and quantities due in. The listing also provided a detailed break-out by site so that re-packaging and special handling requirements at Middletown could be programmed. In addition, the Bill of Materials listing furnished the complete project quantities, military exhibits, specifications and stock numbers, commercial specifications if applicable, name of contractors concerned, anticipated delivery dates for the start and finish

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of each contract, the headquarters responsible for the procurement, action and follow-up, and a special remarks column indicating information when appropriate. The Bill of Materials comprised 531 line items with 119 prime contractors. The total weight involved in this particular phase of Grand Union approximated 27,000,000 pounds of equipment and spares. (C)

2. Middletown Storage and Special Handling Requirements.

a. After completion and finalization of the Grand Union Bill of Materials listing, Air Materiel Command delegated to Middletown Air Materiel Area the responsibility for procuring and assembling this materiel by Air Force Supply Directive action or purchase requests as appropriate. In addition to assembling by Grand Union site, Middletown was required to effect special processing as required, re-package and stencil final destination using unclassified Grand Union designations, GU-1 through 11 for shipment to the port of embarkation. Sites by Grand Union designation were as follows:

GU-1	Kodiak, Alaska	
GU-2	Adak, Alaska	
GU-3	Misawa, Japan	
GU-4	Johnson, Japan	
GU-5	Kadena, Okinawa	
GU-6	Itazuke, Japan	
GU-7	Giebelstadt, Germany	
GU-8	Oberpfaffenhofen, Germany	
GU-9	Gardermoen, Norway	
GU-10	Evanton, Scotland	
GU-11	Adana, Turkey	(TS)

b. It became necessary for the Directorate of Materiel, this headquarters, to closely monitor the Grand Union Bill of Materials deliveries and depot actions at Middletown due to the requirement to pull-out certain quantities of Grand Union materiel to support the extended scope of Moby Dick HI training at Lowry Air Force Base. (C)

3. C-119 Aircraft Modifications.

a. To support the peculiar mission of the 456th Troop Carrier Wing, aircraft were modified through contract with Fairchild Aircraft Division. This contract was scheduled for phased completion by 1 August 1955. The work was accomplished at Fairchild Aircraft Division, Hagerstown, Maryland and Charleston Air Force Base, South Carolina. The modifications included equipping 50 aircraft with recovery gear and recovery electronics and communications equipment, in-flight operable doors, dual

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nose gear assembly, dual generators for 16 aircraft to be assigned to the Arctic area, armored elevators, long-range fuel system, Hamilton Standard propellers and R3350/39/39A engines, radar altimeters, driftmeters, G-meters and additional oxygen capacity and engine analyzers. The installation of the G-meters was a late requirement designed to preclude possible structural failures. Additional late requirements included engine analyzer, 6138-1, HF transceiver, SCR-718 radar altimeter, as a result of evaluating operational requirements during the training phase. (U)

b. This headquarters closely monitored the modification schedules at Fairchild and Charleston Air Force Base to insure that CONUS training in support of mission proficiency and Moby Dick Hi would be supported. (U)

c. Although the Fairchild and Charleston Grand Union modifications commenced on 3 April 1955 and were completed ahead of schedule by July 1955, some maintenance difficulties were encountered at Charleston which could have seriously interfered with the operational requirements if special corrective action had not been taken. (U)

d. During this period approximately 50 percent of all serviceable propellers being received from Warner-Robins Air Materiel Area were being rejected as unserviceable, probably caused by improper maintenance inspection at the depot while the props were undergoing overhaul. The 456th Troop Carrier Wing ACCP rate at one time rose as high as 25 percent, caused primarily from lack of serviceable props. This required continual shifting of props from one aircraft to another, to provide as many aircraft as possible available for training. During the conduct of the preparation for overseas movement inspection being performed by a team from this headquarters, Headquarters USAF was requested to assign to the 456th Troop Carrier Wing an over-riding priority for propeller re-supply, not only to support current training requirements but also to provide for deployment and flyaway kit requirements. On 15 September 1955, the priority was granted by Air Staff and transmitted to all responsible agencies. Propeller difficulties gradually improved which allowed training and overseas deployment plans to proceed on schedule. (U)

4. Moby Dick Hi. To complete an operational serviceability test of System 119L and to accomplish minimum training required for both launch and recovery during Moby Dick Hi, it was necessary to accumulate sufficient materiel to support 22 launchings at Lowry Air Force Base, instead of the originally programmed 25 launches. The launch training was conducted concurrently with and subsequent to the operational serviceability test over a period extending

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through the middle of September 1955. The materiel requirements to support the operational launchings at overseas sites had been placed on contract with deliveries anticipated to be in place in sufficient time to meet the operational deadline date. However, the additional equipment required to satisfy the extension of the original Moby Dick Hi launches from a figure of 25 to 162 launches was a new operational requirement and had not been programmed. Consequently, it became necessary for this headquarters to expedite, through Air Materiel Command, production scheduled and withdraw specific quantities of equipment from operational assets, located either at contractor facilities or Middletown Air Materiel Area, and divert them to Lowry Air Force Base. By daily contacting various contractors and arranging expedited surface and air transportation to Lowry Air Force Base, the extension of Moby Dick Hi was supported materiel-wise. (U)

5. Moby Dick Far East.

a. During the period 1 August 1955 through November 1955 and prior to the deployment of the 456th Troop Carrier Wing, to Far East Air Forces and Alaskan Air Command, the 6926th Radio Squadron (Mobile) direction finding sites had been erected and manned. To support an intensive training program for the direction finding sites similar to that being conducted at Lowry and Charleston Air Force Bases under the extension of Moby Dick Hi, it was decided that materiel had to be obtained to complete 230 flight assemblies to be launched from Far East area to include: H/F transmitters, sufficient launch and test equipment to support 2 launch sites and sufficient lifting gas and ballast. (U)

b. Of the total of 230 flight assemblies desired to be released from the Far East Air Force area, Air Research and Development Command provided 50 Moby Dick Hi electronic packages and 35 of the 124A series balloons with certain launch equipment. The balance of 124A balloons was procured by Air Materiel Command. The remaining electronic systems were obtained from 119L assets and subsequently shipped to Lowry Air Force Base, or directly to the two Pacific launch sites. Here again, a specific Bill of Materials, developed by Headquarters Command, in coordination with Air Materiel Command, required monitoring by this headquarters to insure that in-place operational dates were met. Also, certain items of test equipment had to be deployed to FFAF sites. (U)

6. Preparation for Overseas Movement Inspection of the 1110th Air Support Group. In accordance with special authority obtained from FFAF Manual 75-37, this headquarters conducted a preparation for overseas movement inspection of the 1110th Air Support Group, 29 August through 3 September 1955. Specific materiel areas inspected were: equipment, supply records and

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procedures, clothing, accountability and packaging and marking of unit equipment and impedimenta. One major discrepancy noted at this time was the unsatisfactory status of personal clothing. Corrective action was taken later by the 1110th Air Support Group and this condition was alleviated prior to deployment. (U)

7. Preparation for Overseas Movement Inspection of the 456th Troop Carrier Wing: A preparation for overseas movement inspection was conducted of the 456th Troop Carrier Wing in accordance with the special authority granted this headquarters, as cited above, on 6 September through 14 September 1955. The same materiel areas were covered and no major discrepancies were reported. (U)

8. Aerial Re-Supply Plan.

a. As soon as materiel responsibility was assumed by this headquarters from Tactical Air Command and Headquarters Command it was realized that the 180-day flyaway kit, although designed to make the 456th Troop Carrier Wing self-sufficient for 6 months, would not in practice do so without a high priority re-supply from the CONUS. This also would prove true for the 1110th Air Support Group as no Bill of Materials or flyaway kit could actually anticipate every requirement for an operation of this nature. (C)

b. In cooperation with Air Materiel Command an aerial re-supply plan was developed and published providing certain deviations from Air Force Manual 67-1. Its salient features provided: (1) All FFAF and Alaskan Air Command requisitions would be submitted by the theater directly to the 3:03d Logistical Control Group at Oakland, California, (2) All USAFE requisitions would be submitted by the 1110th ASG directly to MAAMA, (3) All re-supply would be by air, and (3) 456th TCW flyaway kit would be attrited generally to a 90-day level before re-supply would be requested. (C)

c. Wide distribution was made of this plan to all participating agencies to insure that personnel, unable to have access or clearance to the overall operational plan or order, would be informed as to their respective areas of responsibility. (U)

II. PERSONNEL and EQUIPMENT MOVEMENTS OVERSEAS.

A. On 9 August 1955 a conference was held at Headquarters United States Air Force with representatives of this headquarters and participating units. The purpose of this conference was to

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resolve dates and methods of movements of tactical units to overseas theaters so that they would be in place and operational prior to the receipt of the Execution Order. At this time, all detachments of the 6926th Radio Squadron (Mobile) were either enroute or already at their overseas destinations. (U)

b. Due to the unprogrammed extension of Moby Dick HI training both at Charleston and Lowry Air Force Bases, considerable difficulty resulted as to the method of moving these units overseas to meet the in-place date at their overseas destinations of 1 November 1955. These difficulties were further aggravated by the non-availability of USAF airlift for the 456th Troop Carrier Wing to their overseas destinations, although original planning had envisioned total airlift of this unit. As a result the surface deployment phases for the movement of the 456th required very close coordination of train movements from home station to the Pacific port and the scheduling of specific Military Sea Transportation Service ships to meet the in-place deadline date. In this connection aircraft utilization at Charleston Air Force Base was reduced to a minimum required to maintain aircraft in an operational status and prepare them for an overseas deployment. (U)

c. It was finally determined that using a maximum surface movement for the 456th Troop Carrier Wing, an absolutely irreducible airlift of an equivalent of eight C-124 sorties would be required to accomplish the final movement of the rear echelon which remained behind to prepare the C-119 aircraft to proceed from Charleston through Ardmore, Oklahoma and McChord Air Force Base to their overseas staging and final destinations. The essential airlift of the final rear echelon was effected by Tactical Air Command. The C-119 tactical aircraft from Charleston, South Carolina staged through Ardmore, Oklahoma and McChord Air Force Base, Washington. By "leap-frogging" over units and flying kits already pre-positioned in northern sites, all flight echelons were furnished enroute material support without a requirement for staging or special support aircraft. (U)

d. Little difficulty was encountered in establishing movement schedules for the overseas deployment of the 1110th Air Support Group, as this unit had originally been planned to move overseas by surface. The only adjusting action required was to shorten by approximately 10 days their home base departure date. (U)

e. All deployments were carried out on schedule and all personnel, equipment and aircraft of the 456th Troop Carrier Wing were in place prior to the planned operational date. (U)

f. The 456th TCW deployed by surface with flyaway

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kits totalling approximately 750,000 pounds, 60 power packs weighing 350,000 pounds, 60 propellers weighing approximately 72,000 pounds (all representing a 6-months support package) and a total of 1,200,000 pounds of unit mission equipment. The utilization of 175 Conex containers contributed greatly in monetary savings and the smoothness with which this materiel moved from Charleston to the Pacific ports and to end destinations. (U)

g. Due to the magnitude of the unit mission equipment required to support the launch operations of the 1110th Air Support Group, it was pre-assembled at Middletown and moved from Hampton Roads Port of Embarkation through existing Military Sea Transportation Service channels. With a slippage in the CONUS port deadline date at Hampton Roads Port of Embarkation from 1 September to 1 October 1955, shipments did not start from Middletown until the latter part of September. The generation of new unprogrammed materiel requirements during the period of Moby Dick Hi, arising from our training experience at Lowry Air Force Base, aggravated the shipping deadline difficulties. (U)

h. During the early part of October it had become apparent that movement schedules from Hampton Roads to overseas destinations, utilizing Military Sea Transportation Service vessels solely, could not meet our in-place date of 1 November 1955. At the request of this headquarters, both Strategic Air Command, Military Air Transport Service and Air Materiel Command C-124 aircraft were utilized in the transport of many critical items. Flights departed from Wright-Patterson, Offutt, Langley, Minneapolis, March and Dover Air Force Bases and, in most instances, were terminated at Rhein-Main, Germany. A total of 26 sorties were involved and 531,374 pounds, 44,613 cubic feet were expedited through these special airlifts. (U)

III. SUMMARY, CONCLUSIONS and RECOMMENDATIONS.

A. With the completion of CONUS training, overseas deployment and launch operations, it is now apparent that the assumption by this headquarters of logistical responsibility from Tactical Air Command and Headquarters Command was successful with no increase in Director of Materiel personnel necessary. In addition, the aerial re-supply plan was very effective in maintaining both launch and recovery operations in a world-wide operation, probably the largest, logistically, in the history of a peacetime Air Force. The advantages gained from centralization in procurement at Air Materiel Command, storage at Middletown Air Materiel Area, and transportation and logistical responsibility at this headquarters, prior to overseas deployments, outweighed the disadvantages usually experienced whenever normal channels or procedures are

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by-passed. The same is also applicable to our overseas re-supply plan wherein the depot re-supply was centralized at the 3103d Logistical Control Group for Far East Air Forces and Alaskan Air Command, and at Middletown Air Materiel Area for United States Air Force in Europe. (U)

b. It is inevitable in a project of this nature that new, unprogrammed operational requirements will create materiel difficulties. However, if operational control had been delegated to this headquarters much earlier in the program, many other materiel problems could possibly have been avoided. The assumption that a 130-day flyaway kit could sustain a 130-day operation without re-supply resulted in an abnormal drain on Air Force assets of C-119 spares. This adversely affected C-119 support in other commands and theaters not directly connected with this project. When this headquarters assumed materiel responsibility it was already too late to amend the flyaway kit concept as large quantities of materiel were already on hand or enroute to Charleston Air Force Base. Consequently, the 456th TCW deployed with a full six-months flyaway kit. Another assumption that the 456th TCW would deploy overseas by air was not presented to Headquarters USAF as a programmed transportation requirement. This necessitated a last minute scheduling of specific Military Sea Transportation Service vessels to enable personnel and materiel to be in place prior to the arrival overseas of the tactical C-119 aircraft. (C)

c. The late arrival of Grand Union Bill of Materials items shipped from Hampton Roads Port of Embarkation and New York Port of Embarkation to USAFE could possibly have been avoided if prior coordination had been effected between Air Materiel Command and United States Air Force. As an example, controlled MSTTS vessels could have been used. (U)

d. In monitoring or directing materiel aspects for Moby Dick Hi, unit movements overseas and expediting of late receipts from contractors, this directorate expended in excess of \$3,000.00 for phone calls and approximately 550 man days TDY. In excess of 500 unclassified and 750 classified messages were dispatched by this directorate to monitor or direct these materiel responsibilities. (U)

e. In support of future projects of this nature it is recommended the operational and materiel responsibility be delegated as early as possible to the command which will eventually assume operational control. Further, that all planning aspects, especially of a logistical and transportation nature, be formulated and programmed far enough ahead so that normal transportation media and channels may be utilized as much as possible. (U)

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f. New operational requirements, late contract negotiations and preparation of spares and spares kits and the assignment of unqualified, un-cleared technical representatives could be avoided in the future if adequate time is provided for thorough logistical planning prior to operation. (C)

g. In conclusion, it can be stated that the supply priority JL-0 assigned to this project and the outstanding support rendered by all echelons of command contributed greatly to the materiel success of Project 119L. Special cognizance should be given to the excellent support afforded by the overseas theaters and the 3101st and 3103d Logistical Control Groups. (U)

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FINANCE

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I. FINANCE.

A. Staff finance service for this headquarters was provided by the finance staff of Strategic Air Command Headquarters. Finance service for the operating units was provided by the respective supporting bases. (U)

1. The principal problems in this area were:

a. The refusal of payment by the finance office at Johnson Air Base (FEAF), Japan on travel vouchers for extended temporary duty at that location of the personnel of Detachment 1, 746th Troop Carrier Squadron. Based on representation by Headquarters, Strategic Air Command and this headquarters and formal transmission of the finance office's refusal, the Director of Finance, Denver, Colorado, advised Headquarters, Far East Air Force that all vouchers for such purpose should be processed for payment without delay. (U)

b. A request by the 456th Troop Carrier Wing for a special per diem allowance to cover additional cost incurred due to restriction on movement of dependents and privately owned vehicles to overseas location of duty. This request was considered to have merit; Headquarters, Strategic Air Command plans to utilize this information in an overall study, of this area of additional cost without reimbursement, for presentation to Headquarters, United States Air Force. (U)

II. BUDGETING AND ACCOUNTING.

A. Since responsibility for only operational control was given Commander in Chief Strategic Air Command by Headquarters United States Air Force letter, 21 March 1955, the Headquarters 1st Air Division had primary responsibility only for the fund requirements of its headquarters. Other major air commands had primary responsibility for providing funds for their respective participation or support by furnishing units and/or facilities. Following this concept, Strategic Air Command was responsible for funding the Reconnaissance Technical Squadrons and Headquarters 1st Air Division. The three organizations for which Headquarters 1st Air Division exercised operational control received funds for parent command responsibilities from Headquarters Command, Tactical Air Command and United States Air Force Security Service. Funds for normal base support of the tenant units were provided by the Air Force Base on which they were located. This concept, together with procedures for inclusion in fiscal year 1956 financial plan was contained in TWX from Headquarters United States Air Force to Headquarters

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1st Air Division and other messages to the other major air commands during April 1955. Headquarters 1st Air Division reviewed an information copy of the financial plan of other major air commands as they pertained to Designator 119L (unclassified designation for the primary mission), to insure feasibility and conformance with the mission, and forwarded comments and recommendations to Headquarters United States Air Force. The initial financial plan for Designator 119L from the nine major air commands totaled approximately 8.2 million dollars. This amount pertained to local fund requirements and was generally for maintenance and operational requirements. (S)

B. In addition, Air Materiel Command was issued approximately \$58,000,000 by Headquarters United States Air Force for central procurement of major and peculiar materiel for this mission. Additional funds were issued by Headquarters United States Air Force to Air Research and Development Command for research and development and to Military Air Transport Service for Aeronautical Chart and Information Center. Headquarters 1st Air Division had no responsibility for review action in connection with these funds. (S)

C. By message dated 23 September 1955, Headquarters United States Air Force changed the policy on who would be responsible for providing funds for parent command items of responsibility for the period through 30 April 1956. The change placed the responsibility on Strategic Air Command for civilian personnel, temporary duty travel, and extraordinary expenses when the original amount as issued in the initial Annual Budget Authorization to the other air commands proved insufficient. Headquarters United States Air Force stated that experience had shown that a change was necessary in order to assign fund responsibility to the same agency having operating program direction and control. This implied that Headquarters 1st Air Division had made significant program changes requiring additional funds; this was contested by Headquarters 1st Air Division and Headquarters Strategic Air Command. Also this change in funding policy made Strategic Air Command responsible for any fund requirements for local purchase of hydrogen in the United States Air Forces in Europe area in contrast to the original letter from Headquarters United States Air Force to United States Air Forces in Europe of 3 November 1954 making this the responsibility of United States Air Forces in Europe. This change in funding policy was the subject of reclama by Strategic Air Command, but ended in initial failure. It was estimated that this change would cost Strategic Air Command from \$200,000 to \$500,000, with no indication of additional funds being received. However, this change in funding policy was superseded (by Headquarters United States Air Force message cite AFABF-8 57204, 6 Mar 56) following submission of the 2d revision to the fiscal year 1956 Financial

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Plan and fund responsibility reverted to the original policy, viz., in accordance with paragraph 40204, Air Force Manual 172-1, as amended. Requirements of this mission were to be funded on a relative priority basis; requirements due to Strategic Air Command directed program changes for which other commands did not have the capability to absorb, would be documented and submitted to Headquarters United States Air Force through Headquarters Strategic Air Command. (U)

D. The first revision of the financial plans, due Headquarters United States Air Force 31 October 1955, and the second revision due Headquarters United States Air Force 31 January 1956, were reviewed and recommendations were forwarded by Headquarters 1st Air Division. No adjustment action was taken on the 1st revision by Headquarters United States Air Force. (U)

E. During the execution of the mission, there were a number of differences arising with other major air commands, relative the responsibility for providing funds in certain specific cases. However, these were resolved in a manner to preclude any detrimental effect on the mission. (U)

F. During August 1955, additional funds were secured from Headquarters United States Air Force for Air Materiel Command in the amount of one and a half million dollars for the procurement of locator beacons; this was a new item considered essential to the mission. (U)

G. As a result of a request by Headquarters Strategic Air Command during the early phases of the activities of Headquarters 1st Air Division, Headquarters United States Air Force advised by TWX they were requiring no special expense accounting by major air commands for this mission. However, it has been estimated by this headquarters that during the first half of Fiscal Year 1956 it cost approximately \$50,000 per day for maintenance of the operating units in an operational status: this included such items as pay and allowance of personnel, temporary duty travel costs, subsistence, accommodation charges and per capita tax, Avgas, and contractual costs for technical representatives. (U)

H. Early in January 1956, Headquarters United States Air Force advised:

1. That the program would be stretched out in order to launch all systems at a controlled (reduced) rate. (U)
2. That launches of 124A type balloon should be made

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from three locations in the Pacific area during period of 119L operations. (C)

3. That above changes in concept should be reflected in Strategic Air Command's 2d Revision of fiscal year 1956 Financial Plan (the message did not say whether Strategic Air Command's fund responsibility would be pursuant original policy or the change). A Headquarters Strategic Air Command message of 9 January 1955 requested Headquarters United States Air Force to advise all participating and supporting commands of this extension and expansion so that funding through 30 June 1956 could be provided in the 2d Revision of the Financial Plan in a similar manner as on the initial fiscal year 1956 Financial Plan. Since this amounted to a major program change, Headquarters Strategic Air Command did not feel it was within the meaning of the change in amended funding policy which would require Strategic Air Command to provide the additional funds other than for normal base support of the tenant units. This proposal was approved and acted upon by Headquarters United States Air Force in message cite AFOOP-K 54523, 13 January 1956. (U)

I. The execution of the mission was not delayed or altered due to lack of financial support. The amounts reflected by all major air commands in the initial fiscal year 1956 Financial Plan, as adjusted by Headquarters 1st Air Division recommendations to Headquarters United States Air Force, received consideration by Headquarters United States Air Force in arriving at the total amount of funds for each of the participating and supporting commands for fiscal year 1956. (U)

J. Funds for recovery costs of gondolas by persons or agencies other than the United States military forces were provided by the Director of Intelligence, Headquarters, United States Air Force. These were under budget project 492 for rewards and budget project 458 for all other costs such as temporary duty travel, transportation, packing and crating, etc. The funds were made available to all air attaches and major air commands which might have need for them. (C)

K. The following schedules are attached: (S)

1. Funds

- a. Fiscal year 1956 Financial Plan (as revised).
- b. Obligations by Air Materiel Command.
- c. Obligations by Headquarters 1st Air Division.

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- d. Obligations by 456th Troop Carrier Wing.
- e. Obligations by 1110th Air Support Group.
- f. Obligations by 6926th Radio Squadron Mobile.
- 2. Calculated over-all cost for primary mission.
- 3. Procurement cost for each flight vehicle for:
 - a. Primary Mission.
 - b. White Cloud.

L. Based on the calculated cost for this project of \$80,584,944: (TS)

- 1. Of the 40 packages exploited:
 - a. Each of the 13,813 useable exposures cost \$5,834.00.
 - b. Each of the 17,131 total exposures cost \$4,704.04.
 - c. Each of the 1,984,173 total square miles of charting photography cost \$40.61.
 - d. Each of the 1,661,869 net square miles of charting photography cost \$48.49.
- 2. Each of the 44 total packages returned cost \$1,831,477.14.
- 3. Each of the 399 total successful launches cost \$201,967.40.

NOTE: These unit costs are based on the assumption that the unexpended equipment and supplies will have no value for future use. However, some of the materiel should be useable for other purposes, e.g., EH-15 processors, hydrogen generators, chemicals for hydrogen generation, hydrogen trailers, and locator beacons. (C)

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Fiscal Year 1956 Financial Plan (As Revised)

(As considered by Headquarters United States Air Force for inclusion
in the approved Financial Plan of the respective Major Air Commands)

(Headquarters 1st Air Division 1 July 1955 - 30 June 1956; others 1 July 1955 - 30 April 1956)

	SAC & Hq LAD				TAC (456 TCW)	USAFSS (6926 RSM)	Hq Comd (1110 ASG)
	Total	Hq LAD	\$	\$			\$
Civilian Personnel	108,692	\$22,600	\$	\$			2,800
Temporary Duty Travel	2,324,744	91,000		832,000	21,500		357,349
Transportation	866,558			155,046			41,675
Communications	84,484	10,000		6,842			
Leased Property Rental	2,600	2,400		100			
Contractual Services	221,309			30,521	115,000		2,225
Supplies	1,160,804	11,000		177,052	25,000		91,350
Equipment	51,461,386	5,000		87,706			12,125
Accommodation Charges	457,000						
Repair and Modifications	385,524						
Communications Installations	54,400						

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Fiscal Year 1956 Financial Plan (As Revised)
(Cont'd)

	Total	SAC & Hq LAD	TAC (456TCW)	USAFSS (6926 RSM)	Hq Comd (1110 ASG)
SAC, other Units	\$ 65,000	\$ 65,000	\$	\$	\$
TOTAL	\$57,192,501	\$207,000	\$1,289,267	\$161,500	\$507,524

NOTE: 1. Funds required for subsistence and PCS moves are not included.
2. Funds (\$110,461) for which SAC would be responsible by virtue of the change in funding policy are included under the parent command to which the unit was assigned PCA. (S)

	FEAF	AAC	USAFE	USAF (AFOIN)	NATS	AMC 1/
Civilian Personnel	\$ 33,292	\$	\$	\$50,000	\$	\$
Temporary Duty Travel	43,200		44,996	33,600	901,099	
Transportation	20,000	12,900	150,000	50,000	436,937	
Communications			60,800		6,842	
Leased Property Rental					100	
Contractual Service		33,042	10,000		30,521	
Supplies	176,000	71,058	393,232		216,112	
Equipment	74,500	28,000			131,656	51,122,449

NOTE: 1. Funds required for subsistence and PCS moves are not included.
2. Funds (\$110,461) for which SAC would be responsible by virtue of the change in funding policy are included under the parent command to which the unit was assigned PCA. (S)

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Fiscal Year 1956 Financial Plan (As Revised)
(Cont'd)

	FEAF	AAC	USAFE	USAF (AFOIN)	MATS	AMC 1/
Accommodation Charges	\$ 457,000	\$	\$	\$	\$	\$
Repairs and Modifications	264,524	71,000	50,000			
Communications Installations	17,400	37,000				
SAC, Other Units						
TOTAL	\$1,085,916	\$253,000	\$709,028	\$133,600	\$1,723,217	\$51,122,449

1/ Fiscal Year 1955 - 1956 (s)

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Headquarters 1st Air Division
Obligations Against Local Funds

Category	4th Qtr FY 55	Thru Feb 56 FY 56	Total
Temporary Duty Travel	\$12,169	\$40,296	\$ 52,465
Supplies and Equipment	27,169	6,015	33,184
Supplies	(1,758)	3,528	(5,236)
Equipment	(25,411)	(2,487)	27,898
Communications	1,133	6,425	7,558
Civilian Personnel	5,090	11,384	16,974
Rents and Utilities	<u>1,344</u>	<u>2,464</u>	<u>3,308</u>
TOTAL	\$46,905	\$67,084	\$113,989 (U)

456th Troop Carrier Wing
Obligations Against Local Funds

Category	4th Qtr FY 55	Thru Feb 56 FY 56	Total
Temporary Duty Travel	\$ 23,940	\$ 692,437	\$ 716,427 2/
Supplies and Equipment	226,020	98,003	324,023
Communications		6,642	6,642
Civilian Personnel	1,206		1,206
Rents and Utilities	253	100	353
Commercial Transportation	618	326,347	326,965 1/
Contractual Services	7,129	13,309	20,438
Maintenance of Equipment		(13,309)	(13,309)
Real Property Maintenance	(7,129)		(7,129)
Other Non-Personnel Expense	<u>3</u>	<u></u>	<u>3</u>
TOTAL	\$259,169	\$1,136,388	\$1,396,057

1/ Includes estimate of \$150,000 for return

2/ Projected through March 1956

(U)

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1110th Air Support Group
Obligations Against Local Funds

<u>Category</u>	<u>4th Qtr FY 56</u>	<u>Thru Feb 56 FY 56</u>	<u>Total</u>
Temporary Duty Travel	\$ 7,361	\$248,138 <u>1/</u>	\$255,499
Supplies and Equipment	109,361	39,987	149,348
Supplies	(104,229)	(36,430)	(140,659)
Catalyst	(5,800)	(5,000)	(10,800)
Hydrogen	(46,638)	(18,050)	(64,688)
Other	(51,791)	(13,380)	(65,171)
Equipment	(5,132)	(3,557)	(8,689)
Hand Tools		(440)	(440)
Other	(5,132)	(3,117)	(8,249)
Commercial Transportation	2,262	41,702	43,964
Contractual Services	270	11,410	11,680
Other Non-personnel Expense	575	2,225	2,800
Gondola Return	<u>(575)</u>	<u>(2,225)</u>	<u>(2,800) <u>2/</u></u>
TOTAL	\$119,829	\$343,462	\$463,291

1/ Projected through March 19562/ Pertains to training period only

(U)

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USAFSS (6926th TSM)

FY 56 Obligations Against Local Funds 1/

<u>Category</u>	<u>Thru Jan 56</u> <u>FY 56</u>
TDY	\$ 8,707
Supplies and Equipment	10,270
Commercial Transportation	43
Contractural Services	<u>115,000</u>
TOTAL	\$ 134,020

1/ As reported by Hq USAF

(U)

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COST ATTRIBUTED TO THE PRIMARY MISSION
(Calculated)

SUMMARY

SAC - Hq 1st AD	\$ 1,342,584
TAC - 456th TCW	12,785,066
Hq Comd - 1110th ASG	3,753,128
USAFSS - 6926th RSM	3,131,869
FEAF	577,924
USAFE	94,446
AAC	137,380
ARDC	4,601,000
AMC	51,122,449
MATS	<u>3,038,648</u>
GRAND TOTAL	\$80,038,994 (S)

This information was developed by utilizing, correlating, and adapting material from several sources, e.g., "Estimated Costs of United States Air Force Flying Organizations" prepared by Headquarters United States Air Force; report on status of funds prepared by other commands, such as Air Materiel Command, Air Research and Development Command; financial plan information. The period covered ends 31 March 1956; the beginning date varies on above items and is reflected on supporting schedules. (C)

Cost factors developed from the "Estimated Costs of United States Air Force Flying Organizations" were utilized on other units for such items as personnel training and base support items as well as on the 456th Troop Carrier Wing. The personnel training item is developed with a factor based on an estimated average cost for training an officer and airman for a Troop Carrier Wing organization times the average number of personnel replaced each year. The amount of local funds used was not shown separately where the item was covered by these cost factors, e.g., base support is applied to the receiving unit in this manner even though provided by another command. (U)

Some indirect costs and available capabilities such as

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some headquarters staff personnel, part-time personnel costs, Military Sea Transportation Service. Military Air Transport Service, Strategic Air Command **Communications network**, and assistance by Air Rescue Service and Airways and Air Communications Service are not included. Also initial capital investment cost of common items such as aircraft and real property are not included; procurement of special materiel and maintenance and operations costs are included. (U)

Information from the United States accounting system is not included since special expense accounting for this project was not maintained. (U)

COST ATTRIBUTED TO PRIMARY MISSION
(Calculated)

Pay and Allowances	\$ 11,299,841
Other Base Costs	1,432,607
Personnel Training	2,593,154
Temporary Duty Travel	1,118,468
Civilian Personnel	21,910
Aircraft Maintenance, Base	258,412
Aircraft Maintenance, Depot	2,474,923
Depot Maintenance, Other Equipment	104,099
Depot Supply, Aircraft	402,405
Aviation POL	1,483,505
Reconnaissance Technical Costs	65,000
Contract Technicians	116,160
Contractual Messing	255,060
Communications	197,353
Local Funds	<u>58,762,097</u>
	\$ 80,584,994 (C)

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Strategic Air Command
and
Headquarters 1st Air Division

Pay and Allowances	\$ 676,309
Pay and Allowances - Aircraft and Maintenance Crews	174,000
Other Base Costs	51,965
Temporary Duty Travel	66,000
Civilian Personnel	20,410
Aircraft Maintenance, Base	17,300
Aircraft Maintenance, Depot	159,800
Depot Maintenance, Other Equipment	2,570
Depot Supply, Aircraft	13,930
Aviation POL	95,300
Reconnaissance Technical Costs	<u>65,000</u>
	\$1,342,584

All except the last item are for Headquarters 1st Air Division; this latter item represents the funds programmed by Headquarters Strategic Air Command for the 3 Reconnaissance Technical Squadrons for fiscal year 1956.

The other items are for Headquarters 1st Air Division and are based on:

- a. Period 1 April 1955 - 31 March 1956.
- b. 45 officers, 60 airmen and 6 civilians.
- c. 1 C-97 and 2 C-47
- d. Inclusion of costs for Detachment 1, Headquarters 1st Air Division. (C)

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Tactical Air Command
(456th Troop Carrier Wing)

Pay and Allowances	\$ 5,561,127
Other Base Costs	736,040
Personnel Training	1,385,000
Temporary Duty Travel	712,000
Aircraft Maintenance, Base	238,334
Aircraft Maintenance, Depot	2,291,718
Depot Maintenance, Other Equipment	100,834
Depot Supply, Aircraft	385,003
Aviation POL	<u>1,375,010</u>
	\$12,785,066

Based on:

- a. 1 May 1955 - 31 March 1956.
- b. 289 officers and 459 airmen.
- c. 48 aircraft (United States Air Force estimated costs were based on this number).

Additional temporary duty travel costs are added since it was "extended" temporary duty travel not applicable to the normal unit and not included in the cost factors used. (C)

Headquarters Command
(1110th Air Support Group)

Pay and Allowances	2,530,161
Pay and Allowances - Aircraft Maintenance Crews	36,575
Other Base Costs	311,623
Personnel Training	581,584
Temporary Duty Travel	248,140

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Headquarters Command
(1110th Air Support Group)
(Cont'd)

Civilian Personnel	\$ 1,500
Aircraft Maintenance, Base	2,778
Aircraft Maintenance, Depot	23,405
Depot Maintenance, Other Equipment	695
Depot Supply, Aircraft	3,472
Aviation POL	<u>13,195</u>
	\$3,753,128

Based on:

- a. 1 May 55 - 31 March 1956.
- b. 52 officers, 674 airmen and 1 civilian.
- c. 1 C-47.

Additional temporary duty costs were included since it was extended temporary duty not applicable to the normal unit and not included in the cost factors used. (C)

United States Air Force Security Service
(6926th Radio Squadron Mobile)

Pay and Allowances	\$2,103,910
Other Base Costs	303,916
Personnel Training	571,883
Temporary Duty Travel	36,000
Contractor Technicians	<u>116,160</u>
	\$3,113,669

Based on:

- a. 1 May 1955 - 31 March 1956.
- b. 30 officers and 633 airmen. (C)

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Far East Air Forces

Pay and Allowances Aircraft and Maintenance Crews	\$217,759
Other Base Costs	29,063
Personnel Training	54,687
Temporary Duty Travel	11,340
Contractual Messing	121,680
Communications	<u>143,395</u>
	\$577,924

Costs pertaining to Far East Air Forces Detachment 4 and special costs incurred by Far East Air Forces are reflected above.

Detachment 4 strength was 16 officers and 109 airmen.

Costs for base support furnished by this command are included in the costs for the 456th Troop Carrier Wing and 6926th Radio Squadron Mobile.

Contractual messing pertains to locations of Midway Island and Wake Atoll. (C)

United States Air Forces in Europe

Temporary Duty Travel	\$44,988
Communications	<u>49,458</u>
	\$94,446

Special costs incurred by United States Air Forces in Europe. Costs for base support furnished by this command are included in the cost for the 1110th Air Support Group. (U)

Alaskan Air Command

Contractual Messing	\$133,380
Communications	<u>4,500</u>
	\$137,880

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Alaskan Air Command
(Cont'd)

The above are special costs incurred by the Alaskan Air Command. Costs for base support furnished by this command are included in the cost for the 456th Troop Carrier Wing and 6926th Radio Squadron Mobile. (C)

Air Research and Development Command

Local Funds - Fiscal Year 1955 - 1956 \$4,601,000 (U)

Air Materiel Command

Local Funds - Fiscal Year 1955 - 1956 \$51,122,449

Includes special materiel and technical representatives procured under Budget Project titles:

Service Test Material

Modification of In-Service Aircraft and Component Equipment

Special Purpose Vehicles

Airborne Radio Equipment

Electronic Countermeasure Equipment

Meteorological Equipment

Photographic Equipment

Flying Field and Shop Equipment

Organization, Base and Maintenance Equipment

Organization, Base and Maintenance Supplies (S)

Military Air Transport Service

Military Air Transport - Fiscal Year 1956 \$2,855,346

Military Air Transport - Fiscal Year 1955 162,143

Jackpot and Alaskan Air Command - Fiscal Year 1955 21,159

\$3,038,648

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Military Air Transport Service
(Cont'd)

Local funds as programmed for Fiscal Year 1956 and as reflected on Status Report for Fiscal Year 1955. (U)

Procurement Cost For One Primary Mission Vehicle

Item	Units per Package	Cost per Package	
		128TT	66CT
SECTION IIA - Balloon and Suspension Assembly			
Balloon	1	\$1,761.60	\$ 908.47
Suspension Line Assembly			
Clevis Pin	7	8.96	8.96
Shackles	3	.81	.81
Load Strap	1	12.83	12.83
Nylon Cord	50 ft	12.50	12.50
Rotary Head	1	154.00	154.00
Suspension Bar Assembly			
Wire Rope Assembly	1	195.09	195.09
Parachute Banking Cloth	1	3.41	3.41
Outer Suspension Strap	2	4.04	4.04
Inner Suspension Strap	2	4.04	4.04
Sub-Pole to Parachute Strap	1	2.02	2.02
Support Bar Straps	2	4.04	4.04
Squibs	4	.96	.96
Parachute Assembly	1	103.98	103.98
Nylon Webbing	35 yds	12.25	12.25
1/ 24 Foot Parachute	1	From Stock	From Stock

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Procurement Cost For One Primary Mission Vehicle
(Cont'd)

Item	Units per Package	Cost per Package	
		128TT	66CT
SECTION IIB - DMQ-1 Gondola			
Instrument Case	1	\$ 600.00	\$ 600.00
Window Section	2	300.00	300.00
Instrument Rack	1	125.00	125.00
1/ 24 foot parachute was a condemned item issued from Air Force stock for which cost is not available.			
Control Junction Box	1	42.00	42.00
Camera - Still Picture	1	1,600.00	1,600.00
Film	2 rolls	155.42	155.42
2/ Battery	1		
Data Recorder	1	1,035.00	1,035.00
Film	1 roll	3.60	3.60
Water Containers	380	34.20	34.20
Water Station Kit	1	142.00	142.00
Shackle	1		
Cargo Harness	1	23.77	23.77
Desiccant	1	From Stock	From Stock
Santocel	2	1.94	1.94
Locator Beacon	1	438.00	438.00
SECTION IIC - Communications			
Instrument Carton	1	238.00	238.00
Cargo Harness	1	65.00	65.00
Batteries	4	464.00	464.00

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Procurement Cost For One Primary Mission Vehicle
(Cont'd)

Item	Units per Package	128TT	66CT
Potassium Hydroxide	1 Gal	\$ 4.50	\$ 4.50
Water Container	75	6.75	6.75
IC Transmitter HF	1	234.00	234.00
HF Frequency Kits	1		
Squibs	1	.24	.24
HF Antenna Kits	1	65.00	65.00
2/ Inclusion of battery in the instrument package was a late modification. Few vehicles contained this item.			
Transceiver VHF	1	406.00	406.00
VHF Antenna Assembly	1	169.00	169.00
IM Control Unit	1	190.00	190.00
IB Control Unit	1	890.00	890.00
Cam Sets	1	2.30	2.30
Ballast Control	1	160.00	160.00
Orifice	2		
3/ Aux Ballast Control	1		
SECTION IID - Miscellaneous			
Hopper Assembly (Ballast)	2	390.00	390.00
Harness, Cargo	2	118.00	118.00
Snap Adapter Assembly	4	7.56	7.56
Valve - Steel Dust Ballast	2	60.00	60.00
Squib	4	.96	.96
Ballast	980 lbs	441.00	441.00

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Procurement Cost For One Primary Mission Vehicle
(Cont'd)

Item	Units per Package	Cost per Package	
		128TT	66CT
Radiosonde	1	\$ 31.00	\$ 31.00
<u>4/</u> 2GB0 Unit	1		
Hydrogen - Chemicals and Materiels Only	66CT - 24,800 cu ft		83.70
	128TT - 34,600 cu ft	116.78	
		\$10,791.55	\$9,905.34 (S)

3/ Modification of ballast control unit.

4/ Late modification, this item had not been used prior to termination of project

Procurement Cost For One White Cloud Vehicle

Additional procurement for the 20 vehicles for White Cloud was in the amount of \$5,106.00.

Unit cost of the 124A type balloon was \$180.00 and for the mechanical cut-down device \$25.00. The balance of the above amount provided miscellaneous items such as rubber hose, solder, tape, aluminum foil, nylon cord, etc.

The same type of balloon was used in the Moby Dick Far East exercise. (C)

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TAB Q
PERSONNEL

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I. PERSONNEL

A. General:

1. The 1st Air Division was activated and manned on the conception that it would be only operationally responsible for the 6926th Radio Squadron (Mobile), 1110th Air Support Group, and the 456th Troop Carrier Wing. To minimize the number of personnel required, the 1st Air Division was superimposed on the 3902d Air Base Wing for all support normally afforded any tenant unit. There was little increase in the personnel authorization since activation of the 1st Air Division, however, a total of 7 airmen, Communication Center Specialists, AFSC 29150, were added to the Communication Division to meet the expanded requirement in that area. (C)

2. Initially the 1st Air Division established a Directorate of Plans. After the initial load of planning had been accomplished, this function was under the Director of Operations. As we developed further, we reduced 2 officer positions which had never been filled since no requirements existed. One was an administrative officer, AFSC 7024, in the Adjutant's agency and the other was a Major's position, AFSC 6746, Management Procedures Officer, in the Directorate of Comptroller. (U)

3. Detachment 1, Headquarters 1st Air Division consisting of 3 airmen and 10 officers was organized at High Wycombe, England for the purpose of providing direct control of project activities in the European area. (C)

4. After deployment of the units under operational control of the 1st Air Division, the requirement for furnishing replacements became the responsibility of this headquarters. This function was recognized by Headquarters United States Air Force in June 1955 and provisions were made for all overseas units to request replacements from Headquarters United States Air Force through 1st Air Division. Such requests were evaluated by 1st Air Division and if found valid were then forwarded to United States Air Force for action. A system was also established for providing for the prompt return of personnel to their overseas units whenever they had returned to the ZI on emergency leave. (C)

B. 1st Air Division:

1. The following is a list of the initial and present manning authorization for the 1st Air Division:

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AIRMEN

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH
20470	Intel Opn Tech	1	1
22170	Cartographic Tech	1	1
223XX	Draftsman	5	5
23270	Photo Tech	1	1
27150	Air Opr Spec1	3	6
27170	Air Opr Supv	2	2
29150	Comm Center Spec1	0	7
29170	Comm Center Supv	2	3
43171A	Acft Maint Tech-Recip 1 or 2 engines	1	1
64151	Organ Supply Spec1	1	1
64173	Organ Supply Supv	1	1
64175	Stock Control Tech	3	4
67250	Accounting Spec1	1	1
67270	Accounting Tech	1	1
68150	Stat Spec1	1	1
70230	App Clerk	2	1
70250	Clerk	13	13
70270	Admin Supv	3	7
70270	Steno Tech	1	1
73270	Personnel Tech	2	2
73330	Manpower Mangement Spec1	1	0
73370	Manpower Management Tech	1	2
702XX	(Civ) Clerk	6	5
Total		53	67

OFFICERS

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH
0002D	General Officer	1	1
0016D	Director of Personnel	1	1
0036D	Director of Operations	2	2
0046D	Director of Materiel	1	1
0056D	Comptroller	1	1
0066D	Air Commander	1	1
0076D	Plng & Prog Officer	1	0
1044	Plt, Transport	1	1
1416	Operations Staff Officer	5	5
1435	Air Operations Officer	6	5
1534	Acft, Obsr, Nav	1	1
2016	Intel Staff Officer	1	1
2316	Photo & Crtg Staff Officer	1	1
2334	Still Photo Officer	1	1

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OFFICERS (Cont'd)

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH
2546	Adv Weather Officer	2	2
3016	Comm-Elect Staff Officer	2	2
3024	ECM Officer	1	1
3034	Comm Officer	3	3
6416	Supply Staff Officer	3	3
6424	Supply Officer	1	1
6736	Budget Officer	1	1
6746	Mgt Analysis Officer	1	0
6834	Stat Sv Officer	1	1
7016	Admin Staff Officer	2	2
7024	Admin Officer	1	0
7316	Pers Staff Officer	1	1
70200	Admin Supt	1	1
	Total	44	40

C. 6926th Radio Squadron (Mobile):

1. The 6926th Radio Squadron (Mobile) was organized by United States Air Force Security Service for the purpose of furnishing required tracking Support. The 6926th Radio Squadron (Mobile) consisted of ten (10) detachments that were located as follows: (C)

Detachment 1	Shiroi, Japan	
Detachment 2	Andersen AFB, Guam	
Detachment 3	Wake Island	
Detachment 4	Clark AFB	
Detachment 5	Okinawa	
Detachment 6	Korea	
Detachment 7	Chitose, Japan	
Detachment 8	Midway Island	
Detachment 9	Shemya, Alaska	
Detachment 10	Elmendorf, Alaska	(S)

The headquarters of this organization was located at Shiroi AB in Japan, adjacent to the headquarters of the 456th Troop Carrier Wing. (S)

2. Personnel comprising this organization were reassigned mostly from ZI commands, however, Far East Air Force was responsible for furnishing a substantial number. Individuals were scheduled to be in place at their overseas locations not later than 1 August 1955. The organization never functioned as an integral unit prior to beginning of their overseas operation. (C)

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3. Far East Air Force was unable to furnish 90 radio operators to the 6926th Squadron. In lieu thereof 1st Air Division was forced to accept graduates of the radio operators school at Keesler Air Force Base. This action delayed the 100% in place manning date and further added to the already immense training problems. At the beginning of this project the 6926th Radio Squadron (Mobile) had an authorization of 30 officers and 633 airmen. This was changed by deletion of 10 airmen, AFSC 70250, clerk-typist, and substitution therefore of 10 airmen, AFSC 73250, classification technicians. In addition there was an increase of 3 airmen, AFSC 73251, personnel specialists, for assignments to 3 detachments at the more remote stations, due to limited support personnel available thereat. (C)

4. In October 1955 a survey flight was made to all of the 6926th detachments to determine the overall readiness of the units. The detachments were found fully manned with officer and key non-commissioned officers. The training of the younger airmen had to be greatly increased if they were to satisfactorily perform their duties in connection with this project. (U)

5. Plans were made in November to hold a realistic Command Post Exercise that would determine the number of balloons needed to saturate the tracking facilities in the Far East. As a result of this exercise, the 6926th Radio Squadron (Mobile) proposed an increase of radio operators to enable them to adequately man their detachments on a 24 hour, 7 day a week basis. (S)

6. No action could be taken at this late date to obtain changes in the Unit Manning Document and requisition personnel for such increases through normal channels. However, Headquarters United States Air Force Security Service agreed and furnished approximately 40 radio operators from their overseas resources on an over-manning basis. These 40 airmen were distributed throughout the detachments enabling continuous tracking capabilities. (C)

7. The following initial and final manning document authorizations for the 6926th Radio Squadron (Mobile) are listed as an aid in establishing proper manning tables if an operation of this nature were to be conducted on a 24 hour, 7 day a week basis in widely scattered and remote overseas areas. (C)

AIRMEN

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH
29230/50	Crypto Opr	32	72
29370	Radio Oprn Supv	45	45
29350	Ground Radio Opr	450	450
30430/50	Radio Relay Equip Repmn	71	81
30470	Radio Relay Equip Maint Tech	12	

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AIRMEN Cont'd

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH	
36330/50	Comm Machine Repmn	3	3	
36371	Crypto Maint Tech	1	1	
47155	Sr Veh & Motorized Equip Elec	11	11	7250
64151	Organizational Supply Spec1	22	22	
64173	Organizational Supply Supv	1	2	
70230	Apprentice Clerk	2	2	
70250	Clerk	15	7	
70270	Admin Supv	1	2	
73170	First Sergeant	1	1	
73250	Classification Spec1	4	11	
73251	Personnel Spec1	12	15	
	Total	683	725	(U)

OFFICERS

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH	
0026	Operation Commander	1	1	
3034	Comm Officer	25	25	
6416	Supply Staff Officer	1	1	
6424	Supply Officer	1	1	
7016	Admin Staff Officer	1	1	
7324	Personnel Officer	1	1	
	Total	30	30	(U)

D. 1110th Air Support Group.

1. During the early stages it was realized that the 1110th Air Support Group could not satisfactorily carry out their operational requirements because they were required to conduct an operation on a vastly deployed scale and on a 24 hour, 7 day a week basis. As a result, areas notably requiring additional personnel were supply, operations, inspection, communication, and administration. The processing of classified airmen reports also required a Reports and Records Control Section in the headquarters and each detachment. (U)

2. The following are detailed comments concerning the more important officer specialties that were added: (U)

a. Five (5) communication officers, AFSC 3034, one per detachment to enable each detachment to be self-sufficient because they were hundreds of miles apart. Each communication officer would provide technical supervision over approximately 35 communication maintenance and operating personnel. Each detachment was required to inspect all balloon - borne communication

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and electronic equipment of which there were approximately 100 communication sets per detachment. Each set consists of an HF transmitter, a VHF transceiver, and an intricate electrical control box. (S)

b. Five (5) administrative staff officers, AFSC 7016, were added to replace the five administrative officer positions, AFSC 7024. This increase in AFSC structure only was for the five detachment commander positions. In addition to the five detachment commander's AFSC 7016, 2 AFSC 7016 were authorized in the grade of Lieutenant Colonel for the executive and assistant executive officer. To adequately control five detachments and the headquarters which were scattered over hundreds of miles, it was necessary to augment the command position for the Unit Manning Document to include these 2 Lieutenant Colonels in order that they might assist the commander. (U)

c. A personnel officer was authorized for each of the five detachments. (U)

d. One supply officer was also authorized for each of the five detachments because of the tremendous supply and logistical commitments in which they were involved. (U)

e. One of the most important increases was the inclusion of six chemists, one chemist in group headquarters and one in each detachment to be in charge of the hydrogen gas generation units. These requirements were necessary because of the complex method of generating hydrogen and because little or no help along this line could be expected at any of the overseas operating locations. (C)

f. At the beginning of our actual operation it was realized that the control room of the headquarters, 1110th Air Support Group, required two additional officers, AFSC 1435. These officers were obtained on a TDY basis from the 7th Air Division overseas. This type of manning action was necessary because of the immediate need for the officers. (U)

3. The following are detailed comments concerning the more important airman specialists that were added to the Manning Document. (U)

a. Twenty weather specialists (radiosonde technicians), four at each site, for the development and operation of a limited radiosonde observation capability in support of an operational requirement for a telemetering device to monitor balloon performance on ascent. (C)

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b. Two crypto maintenance personnel were added at each detachment and one at the main control center because of the inclusion of the python on-line crypto system within the communication network. (C)

c. Ten parachute riggers were added to give each detachment a capability to launch 100 flights per month. It takes 10 manhours to prepare one flight with a monthly requirement for 1000 manhours. Preparation for one flight includes packing of five parachutes and rigging in cluster as well as mounting all special equipment. The old authorization of airmen had the capability of producing only 692 manhours monthly. (U)

d. Six operation specialists, AFSC 27050/70 were added to adequately man the 1110th Air Support Group master control room at High Wycombe on a 24 hour, 7 day a week basis. (U)

e. Four warehouse specialists and one supply records specialist were added to each detachment to meet the tremendous supply and equipment handling requirements. (U)

f. An overall figure of 37 personnel in the administrative field, AFSC 702XX, were added to provide: (U)

- (1) Four clerks for each detachment to administer the operational Reports and Records Section.(U)
- (2) The balance to be authorized in group headquarters to cover positions in their operational Reports and Records Control Section, Communications, Electronics, Operations, Inspection and Standardization, and in the Adjutant's office. The 1110th Air Support Group, being scattered throughout the European area, required many additional administrative and operational reports to flow into their headquarters. For this reason additional administrative type personnel were required to successfully carry out the overall administrative requirements. (C)

g. A medical independent duty technician was authorized for each detachment where there was the absence of on-base medical officers. In this instance fully trained medical independent duty technicians were assigned to preclude unnecessary evacuation of patients. (U)

4. The initial cadre of the 1110th Air Support Group went overseas in July 1955, the main body followed in October 1955.

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The detachments that comprised this group were located as follows: (U)

Headquarters	High Wycombe, England	
Detachment 1	Oberpfaffenhofen, Germany	
Detachment 2	Adana, Turkey	
Detachment 3	Gardermoen, Norway	
Detachment 4	Evanton, Scotland	
Detachment 5	Giebelstadt, Germany	(TS)

5. A manpower ceiling was imposed on Detachment 3 that restricted the number of United States Air Force personnel participating in this project to 100. This number consisted of 7 officers, 5 civilians, and 88 airmen. The remaining personnel of Detachment 3 (approximately 31 airmen) were divided among the 4 remaining detachments of the 1110th Air Support Group and were utilized as replacements for attritional losses. The ceiling was increased to 106 during the course of operations. (U)

6. The following initial manning authorizations as compared with the final authorizations are indicated below:

OFFICERS

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH	
0026B	Commander	1	1	
1416	Operations Staff		1	
1435	Operations		3	
2524	Weather	1	1	
3034	Communications	1	6	
3054	Air Electronics		1	
6034	Transportation		1	
6416	Supply Staff		2	
6424	Supply	1	5	
7016	Administrative Staff		7	
7024	Administrative	15	10	
7316	Personnel Staff		1	
7324	Personnel	1	6	
7516	Educational & Training Staff	1	1	
8566	Chemist		6	
30400	Ground Radio Maint Supt		2	
	Total	21	54	(U)

AIRMEN

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH
22350	Draftsman		1
25150	Ground Weather Equip Cpr		10

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AIRMEN Cont'd

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH
25170	Weather Equip Tech		10
25270	Meteorological Tech		2
27150	Air Operation Spec		3
27170	Air Operation Supv		3
29130	App Comm Center Spec		4
29150	Comm Center Spec	37	37
29170	Comm Center Supv	3	3
29230	App Crypto Cpr		2
29352	Airborne Radio Cpr		1
29450	Balloon Launcher Spec		30
29470	Balloon Launcher Supv		20
30370	Ground ECM Tech		1
30450	Ground ECM Spec	85	
30452B	Ground Comm Equip Repmn		55
30470	Radio Relay Equip Maint Tech	45	
30472	Ground Comm Equip Maint Tech		26
36331	Crypto Machine Repmn		11
36370	Comm Machine Maint Supv	3	3
40250	Photo Equip Repmn	30	30
40270	Photo Equip Repmn Tech	10	11
43151W	Aircraft Mechanic	2	2
47150	Constr Equip Repmn	5	5
47151	Automotive Repmn	5	5
47152	Spec Vehicle Repmn	5	5
47170	Vehicle Maint Tech	5	5
55010	Constr Helper	20	15
55131	App Constr Equip Cpr		5
55151	Constr Equip Cpr	10	5
56250	Gas Gen Plt Opr	115	115
56270	Gas Gen Plt Tech	30	30
58150	Parachute Rigger	15	25
58170	Parachute & Fabric Supv	5	5
60330	App Vehicle Cpr	15	15
60350	Vehicle Cpr	39	34
60370	Motor Trans Supv	5	5
64131	App Orgnl Supply Spec	10	10
64150	Warehousing Spec	10	30
64151	Orgnl Supply Spec	5	5
65152	Supply Records Spec		5
64172	Supply Inspection Tech		1
64173	Orgnl Supply Supv	5	6
70230	App Clerk	1	6
70250	Clerk	8	38
70270	Administrative Supv	1	2

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AIRMEN Cont'd

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH	
73250	Classification Spec1	1	1	
73251	Personnel Spec1	6	7	
73270	Personnel Tech	6	7	
75230	Education Spec1		1	
75270	Education Tech		1	
90270	Medical Service Tech		2	
	Total	542	663	(U)

E. 456th Troop Carrier Wing.

1. As a result of training in the ZI, a few areas such as operations, maintenance, communications, and administration were given additional personnel. (U)

2. The following are detailed comments concerning the officer specialists that were added:

a. Two (2) AFSC 1435, Air Operations Officers, were added to Wing Headquarters to allow the **operations section** to function on a 24 hour, 7 day a week basis. (U)

b. One (1) Flight Safety Officer, AFSC 1434, was considered a definite requirement. Generally the Flying Safety Officer is under the office of inspection. However, the 456th Troop Carrier Wing does not have nor require an Inspection Section, but a definite requirement did exist for the above officer because of the hazardous flying requirements in an operation of this nature. (U)

c. One (1) Aircraft Maintenance Superintendent, AFSC 43100, was added to assist the Wing Aircraft Maintenance Officer. The aspects of their operation, which involved time and distance, required either the Aircraft Maintenance Officer or his assistant to be away from the headquarters a large part of the time to assist the various squadrons in the performance of their maintenance activities. (U)

d. One (1) Supply Superintendent, AFSC 64100, was augmented to the Wing Staff. The distance between squadrons **established** a requirement for additional supervisory personnel. (U)

e. An addition of 13 officers, equally divided between six squadrons, was made to the Manning Document. These

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officers manned the ground cut-down stations in a given recovery area. These cut-down stations provided ground-air balloon flight termination capability on a 24 hour, 7 day a week basis. (S)

3. The following are detailed comments concerning the airmen specialists that were added: (U)

a. One (1) Motion Picture Technician, AFSC 23370, was added to Wing Headquarters so that the Wing could take motion pictures of the operation, produce training evaluation films for the project and also have documentary films covering the entire project. Motion pictures as a training aid are considered of great value in the rapid advancement of flight training phase of any project. (U)

b. The addition of eight (8) Airborne Radio Technicians, AFSC 29372, was very necessary in providing the high degree of proficiency required of air crew radio operators. These airmen continually gave their air crew radio operators proficiency checks, which under normal operating conditions are handled by the Wing Standardization Board. The squadrons being deployed at great distances from Wing Headquarters left a great deal to be desired concerning proficiency checks by any Wing Standardization Board. (U)

c. The 43 Flight Mechanics originally authorized the 456th Troop Carrier Wing were at the 5 level. The degree of proficiency for the 5 level airmen was considered insufficient to carry out an air crew mission as complex as this one. Therefore, to man these positions with more competent and experienced help, the AFSC 43151W was deleted from the manning documents and the AFSC 43171W authorized in lieu thereof. (U)

d. Four (4) additional operations specialists were added to the Wing Headquarters in order to man the Tactical Recovery Control Center on a 24 hour, 7 day a week basis. (C)

e. A few administrative personnel were added under various functions due to insufficient initial manning.

- (1) Administrative Supervisor in the headquarters.
- (2) One (1) First Sergeant in Wing Headquarters Section.
- (3) Personnel specialties to augment Wing Headquarters and Wing Directorate of Personnel and the **airman** aide. (U)

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f. Thirty airmen, Ground Radio Operators, AFSC 29370, were added and equally divided between the six squadrons. These airmen manned the ground cut-down stations on a 24 hour operation. (C)

g. Four (4) airmen, AFSC 29130/50 were added to the two squadrons that operated in the Alaskan areas. These airmen manned the teletype circuit between the two squadrons. (U)

4. The initial cadre of the 456th Troop Carrier Wing was deployed to their overseas operating locations in July 1955. The main body of this organization joined them in November 1955. The squadrons that comprised the Wing were located as follows:

Headquarters	Shiroi, Japan
744th Troop Carrier Squadron	Kadena, Okinawa
744-1 Troop Carrier Squadron	Itazuke Air Base
745th Troop Carrier Squadron	Adak, Alaska
745-1 Troop Carrier Squadron	Misawa, Japan
746th Troop Carrier Squadron	Kodiak, Alaska
746-1 Troop Carrier Squadron	Johnson AB, Japan (C)

The location of the 744th squadron was changed from Iwo Jima to Itazuke, Japan because a typhoon inflicted major damage upon Iwo Jima. (C)

5. The following is a list of the initial and present manning authorizations for the 456th Troop Carrier Wing:

OFFICERS

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH
0002	General Officer	1	1
0066C	Air Commander	1	1
0066A	Air Commander	6	6
0016C	Director of Personnel	1	1
0036C	Director of Operations	1	1
0046C	Director of Materiel	1	1
1054B	Pilot, Troop Carrier	144	144
1416	Operations Staff	3	3
1435	Air Operations	12	14
1444	Flying Safety		1
1534P	Aircraft Observer	49	49
1534	Navigators (cut-down stations)		18
2054	Intelligence	7	7
2524	Weather	1	1
30100	Air Electronic Supt		1
3016	Comm-Elect Staff	1	1
3054	Air Elect	6	6
43100	Aircraft Maint Supt		1

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OFFICERS Cont'd

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH	
4316	Aircraft Maint Staff	1	1	
4344	Aircraft Maint	6	6	
64100	Supply Superintendent	3	4	
6416	Supply Staff	1	1	
6424	Supply	3	3	
6736	Budget	1	1	
6834	Stat Sv Staff	1	1	
7024	Administrative	2	2	
7324	Personnel	7	7	
9356	Medical - Avn Med	6	6	
	Total	265	289	(U)

AIRMEN

20450	Intel Opns Spec	6	6
20470	Intel Opns Tech	1	1
22350	Draftsman	7	7
23370	Motion Picture Cam Tech		1
25250	Weather Observer	1	
25270	Meteorological Tech	1	5
29130	App Comm Center Spec	6	10
29150	Comm Center Spec	24	24
29170	Comm Center Supv	7	7
29352	Airborne Radio Opr	48	43
29370	Radio Opr Supv (cut-down stations)		30
29372	Abrne Rad & Flt Ck Pnl Tech		8
30130	App A/C Radio Reprn	8	3
30131	App A/C Elec Nav Eq Reprn	16	16
30150	A/C Radio Reprn	14	14
30151	A/C Elec Nav Eq Reprn	28	28
30170	A/C Radio Maint Tech	6	6
30171	A/C Elec Nav Eq Maint Tech	6	6
36371	Crypto Maint Tech	6	6
40250	Photo Eq Reprn	12	12
42131	App Acft Prop Reprn	8	3
42151	Acft Prop Reprn	22	22
42152	Acft Hydraulic Reprn	26	26
42171	Acft Prop Tech	6	6
42230	App Instrument Reprn	6	6
42250	Instrument Reprn	16	16
42330	App Acft Elec Reprn	6	6
42350	Acft Elec Reprn	28	28
43131A	App Acft Mechanic	56	56

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AIRMEN Cont'd

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH
43151Z	Acft Mechanic	104	104
43151W	Acft Mechanic	48	
43152	Tow Reel Spec1	48	48
43171A	Acft Maint Tech	93	93
43171W	Acft Maint Tech		48
43231	App Recip Eng Mechanic	16	16
43251	Recip Eng Mechanic	28	28
43271	Recip Eng Tech	12	12
47230	App Grnd Pd&Spot Eq Repmn	6	6
47250	Grnd Pd&Spot Eq Repmn	26	26
47270	Grnd Pd&Spot Eq Repmn	6	6
53250	Metals Processing Spec1	10	10
53270	Metals Processing Tech	6	6
53350	Sheet Metal Worker	6	6
53430	App Air Frame Repmn	16	16
53450	Air Frame Repmn	16	16
53470	Air Frame Repmn Tech	6	6
55250	Wood Worker	6	6
58150	Parachute Rigger	6	6
60133	App Acft Loadmaster	192	192
60150	Air Pass & Opns Spec1	6	10
60170	Air Trans Supv	7	7
60330	App Vehicle Opr	18	18
60350	Vehicle Opr	6	6
62010	Food Service Helper	18	18
62230	App Cook	18	18
62250	Cook	38	38
64131	App Orgnl Supply Spec1	6	6
64151	Orgnl Supply Spec1	25	25
64173	Orgnl Supply Supv	8	8
67270	Accounting Tech	1	1
68150	Statistical Spec1	8	8
68176	Stat Serv Supv	1	1
70010	Administrative Helper	1	1
70230	App Clerk	21	21
70250	Clerk	47	47
70270	Administrative Supv	3	4
70252	Steno Spec1	2	2
72151	Historical Spec1		1
72171	Historical Tech	1	
73170	First Sergeant	6	7
73250	Class Spec1	8	8
73251	Personnel Spec1	6	8
73270	Personnel Tech	8	8

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AIRMEN Cont'd

AFSC	TITLE	INITIAL AUTH	PRESENT AUTH	
75270	Education Tech	1	1	
77150	Air Policemen	84	82	
77170	Air Police Supv	6	6	
90250	Medical Serv Spec1	14	14	
90650	Medical Admin Spec1	8	8	
92250	Surv Tng & Pers Eq Spec1	12	12	
99015	Unclassified Airman			
99018	Airman Aide		1	
Total		1410	1463	(U)

6. During the training period in the ZI it was noted that the 456th Troop Carrier Wing was well manned in most respects to carry out their operational requirements. Two squadrons were selected for cold weather operation. These two squadrons have an increased manning authorization, over the other squadrons, of approximately 60 airmen. (U)

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TAB R

ANALYSIS

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I. ANALYSIS:

A. Launchings started on 10 January 1956, with maximum numbers of balloons limited in accordance with higher headquarters directives. A total of 516 launches were accomplished by 6 February. The following operational data are based on the official status reports as of 1 March, and only gross data will be presented in this section. Data by balloon are given in the IBM listing. (Chapter VI) Camera performance records are presented in Tab "J", Chapter III. (IS)

Gross Performance Record (10 Jan - 6 Feb)

Launch Site (A Code No.)	No. Launched	Succ. Ascent No. %	Fixed No. %	Arrived No. %	Recovered No. %
Adana (2)	165	151 91.5	49 29.3	45 27.4	30 13.0
Cardarmoen (3)	34	27 79.5	9 26.4	4 11.3	0 0
Evanton (4)	103	60 58.0	4 4.0	1 1.0	1 1.0
Oberpfaffen- hofen (1)	107	33 31.5	17 15.8	7 6.5	6 5.6
Gibelstadt (5)	107	73 68.0	22 20.6	10 9.3	7 6.5
Total	516	399 77.5	101* 19.4	67 12.9	44 8.5

*See note at end

1. For the purpose of this analysis, an ascent is called "successful" if the balloon is not known to have failed within two hours. The "number fixed" is the number of balloons on which one or more position fixes were obtained. It does not include balloons for which a bearing only was obtained. The number "arrived" is the number of balloons believed to have crossed the area of interest and entered into the general recovery area. It does not include balloons which failed to penetrate area of interest or which may have penetrated but strayed into neutral or friendly areas shortly after launch. "Number recovered" is the number of payloads which had come into possession of the 1st Air Division by 6 March. (IS)

B. Productivity of Sites. Adana contributed two-thirds of all balloons arriving and 70% of those recovered. At the other extreme, Evanton was relatively the least productive by far with only one arrival (and recovery) out of 103 launched, or approximately 1% arriving. Cardarmoen, with 12% arriving, ranked next to Adana on the arrival list but, primarily because of the northern swing of the trajectories in the terminal area, no balloons have

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been recovered to date. There was no significant difference in the productivity of the two German sites with about 8% of the launched balloons arriving in the recovery area and 6.1% recovered. (TS)

1. Two types of balloons - the 66CT and the 128TT, are involved and the 128 group has been classified into late and early manufacture, with serial number 950 as the break-point between the two. Gross tabulations by type of balloon follow:

		Number launched	Succ. ascent	Fixed	Arrived	Recovered
Type 66	ADA	138	128	36	35	24
	EVA	87	51	4	1	1
	GAR	15	13	4	1	0
	OBE	83	70	13	5	4
	GIE	<u>88</u>	<u>63</u>	<u>17</u>	<u>5</u>	<u>3</u>
	Total	411	325	74	47	32
% of launched		100%	79	18	11.4	7.8
Type 128 (late)						
	ADA	27	23	13	10	6
	GAR	19	14	5	3	0
	EVA	7	7	0	0	0
	OBE	<u>22</u>	<u>17</u>	<u>4</u>	<u>2</u>	<u>2</u>
	Total	75	61	22	15	8
% of launched		100%	81	29.2	20	9.3
Type 128 (early)						
	EVA	9	2	0	0	0
	OBE	2	1	0	0	0
	GIE	<u>19</u>	<u>10</u>	<u>5</u>	<u>5</u>	<u>4</u>
	Total	30	13	5	5	4
% of launched		100%	43	16	16	13.4 (TS)

C. Ascent Success. Launch limitations initially imposed by higher headquarters caused certain modifications in planned launch condition rules, but the overall ascent success rate of the type 66 fairly closely approximated pre-mission estimates. Test data obtained on the type 66 during the Moby Dick Hi operation in the summer of 1955 were for pre-production items only and inadequate for firm statistical estimates. The "late series 128" exhibited an ascent success rate of 81% which exactly equalled the rate obtained from the 32 launchings in late summer. The "early series of 128" was tried initially at Evanton with an

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apparent successful ascent rate of only 22%. This discouraged further testing at Evanton and later trials with the early series at the German sites yielded an ascent success rate of slightly over 50%. The overall experience with 30 launches fielded a rate of 43% which again coincides with the experience at Lowry during the summer. The discontinuance of the "early 123" launches at Evanton was certainly justified for operational reasons, but it should be noted that the 66 ascent success rate was also significantly lower at Evanton than at any other site. Conditions at Evanton appear to have been enough marginally worse to effectively kill the "early 123". A quick summary of summer results versus this operation follows:

		Moby Dick Hi		Current Operation	
	No.	Ascent Success Rate	No.	Ascent Success Rate	
		(Approx.)		(Approx.)	
66	15	90%	411	79%	
123 late	32	81%	74	31%	
123 early	104	45%	30	43%	(C)

It may be argued that the comparison is not valid since most of the early 123s flown during the summer were programmed for the design profile, but examination of the records discloses that over 90% of the summer failures occurred at altitudes below 50,000 feet, i.e., below the initially programmed altitudes for the balloons in this operation. (C)

D. Free Lift. Operational considerations made avoidance of "stump dodgers" (underinflated balloons) mandatory, and lack of data on the 66 from the summer test indicated the desirability of some experimentation with free lift. A review of the first 419 launches indicated little or no difference in either ascent success rate or arrival rate for the 66 as free lift was varied between 7 and 10%. Ascent success for the 66 seemed to hold up through 10% free lift but 7 out of 9 failed in ascent with 20% free lift. No 66 with a free lift of over 10% arrived in the recovery area but the sample is small. The 123 showed no significant variance in either ascent success or arrival rate for 34 cases in the 7-3% free lift range. Three additional cases were tested at 10%, two ascended successfully and one of these arrived. For subsequent launches it was agreed to standardize on 5-10% with 7% desired for 123's; 7-15% with 10% desired for 66's. Two 66's were launched later at 15%, both ascending successfully but neither arriving. In summary, the experimentation with the higher free lifts can, at the most, account for only a very small percentage of the ascent failures, and, in addition, an undetermined but relatively small percentage probably can be explained in terms of obviously adverse weather at the launch site. (C)

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1. Considering these factors, together with early series 123 contributions, the overall percentage of successful ascents, 77.5%, is not seriously out of line with pre-mission estimates and test experience. (U)

E. Arrivals. Of the 399 balloons which are believed to have ascended successfully, only 67 or one out of six are credited with arriving in the terminal area. The obvious possible factors contributing to the low arrival percentage are: trajectories and balloon duration, attrition by not friendly interests, instrumentation system failure, and failure of balloons thought to have been successful, e.g., leakers. Trajectories and balloon duration are intimately related and are treated as a single factor. (S)

1. In the next tabulation the "fixed" and "arrival" data are presented in a slightly different form with the percentage calculated using the preceding column as a base:

Site	No. Succ. Ascents	Fixed		Arriving	
		No.	%	No.	%
ADA	151	49	32	45	92
CAR	27	9	33	4	45
EVA	60	4	7	1	25
OBE	33	17	20	7	41
GIE	<u>73</u>	<u>22</u>	<u>30</u>	<u>10</u>	<u>45</u>
Total	399	101	26	67	17

(S)

The percent of successful ascents "fixed" shows a remarkable consistency for ADA, CAR, and GIE with OBE lower but in the same ball park and EVA significantly lower than the rest. Initial turn-on times for the fix gear were set at launch plus, 50, 64, 90, 80, and 30 hours for ADA, CAR, EVA, OBE, and GIE respectively. On 1 February, 12 hours were added at all sites except ADA, and on 3 February, an additional 18 hours at all sites except ADA. The additional times, with the calculated risk of over-flight, were set in order to obviate early tracking as a possible aid to unfriendly interest. In addition to the 101 "fixed" (i.e. one or more fixes), there were 21 and possibly 22 for which an initial transmission only was heard by one station resulting in a bearing with no fix, and 21 for which the termination came from "ghosts" and were heard after the programmed turn-on time of the HF, eight at between 20 and 70 hours after launch. Eleven before 20 hours after launch. On 29 January 1956, action was taken to modify gear so that a termination signal would be transmitted at any time after 90 minutes from release, and/or separation of main and sub-poles. Listening services on the launch side were asked to survey channels. There was no noticeable change in frequency of detection of termination signals. (TS)

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2. One interesting operational factor was derived from the performance of the "fixed" balloons. In approximately two out of three cases where fixes were obtained, the balloon was first heard within two hours of the programmed turn-on time. (S)

3. In summary, then, approximately 140 of 399, or 35%, "came alive" or were heard from after ascent or, conversely, 65% were never heard from and 75% were never fixed. And the lack of signs of life was a source of concern from the very beginning of the operation. During the Moby Dick Hi tests, in a total of 18 out of 72 successful ascents (i.e. 25%) the instrumentation failed (did not turn on, was intermittent, or failed before balloon), but this was pre-production equipment and better performance was expected of the production items. One possible valid explanation of the apparently low performance lies in the tangling of the antennas in the case of a prematurely descending package, but this is applicable only if the package descends prematurely. (C)

4. The percentage of "fixed" which arrived is extremely high (92%) from ADA. From this site, natural life would not be expected to be as significant a factor and less vulnerable trajectories would be expected. The 3% not arriving after being fixed is operationally explainable and acceptable. The percent of "fixed" which arrived from CAR, CBE, and CIE show a remarkable consistency in the 40-45% region, so that slightly over half disappear due to trajectory and duration, attrition, and instrumentation failure, i.e. become ghosts before known arrival. EVA arrivals are only 25% of "fixed" but the sample is too small to be significant by itself. The trend, however, is in the proper direction if duration-trajectory is a primary factor. (TS)

F. Duration-Trajectory. Of the 67 vehicles arriving, durations are known for 54. Following is a summary:

Duration of Terminated Balloons by Launch Site
(57 terminations, 54 with known duration)

	No.	Min (hrs)	Max (hrs)	Mean (hrs)	Standard Deviation	
ADA	33	50	98	62	9.0	
CAR	1	--	--	133	--	
EVA	1	--	--	159	--	
OBE	7	91	129	119	12.5	
CIE	*7	91	119	107	12.1	(S)

(*One case with reported 217 hrs duration not included in mean or sigma)

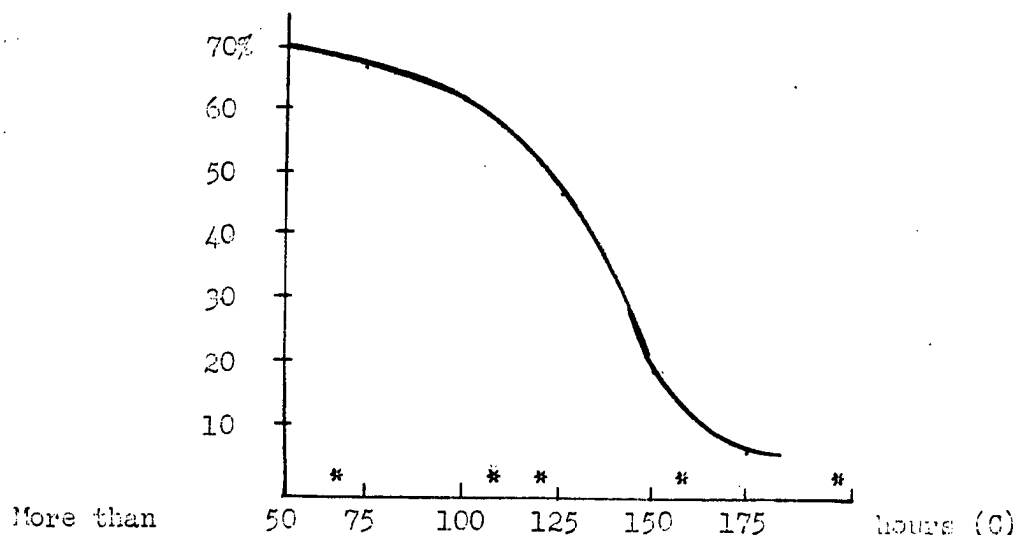
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The only available operational statistics, which by a stretch of the imagination might be used for comparison, are from Moby Dick Hi. Here there were mixed balloon types, mixed profiles, and a training situation, with operational considerations which forced early terminations of some of the willfully terminated balloons, and some indeterminacy re the actual duration of terminations classed as "indefinite" (cause not known). The distribution of durations derived from Moby Dick Hi is known graphically as follows:

Duration of "terminated" or "indefinite" balloons
(72 successful ascents, Moby Dick Hi, Summer 55)

Asterisks along base line indicate mean durations
for five sites derived from preceding table.



The curve above at least serves to illustrate the best operational data available, the statistical nature of durations, and the rapid drop off after 100 and 125 hours of life. Actually, if the number of sunsets (or ballasting periods) had been used instead of hours, the decreases would tend to be more in the order of steps rather than a smooth curve, and the criticality of an additional sunset would be more apparent. If the curve has only validity, and if the mean durations of those terminated is typical of flight times from their launch sites, about 35% of the successful ascents from ADA and 45-50% from the German sites would have been expected to fail before arrival. The duration samples from EVA and CAR are too small to consider but the duration trend is consistent with the larger transit distance and would suggest a percentage of failure

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higher than for the German sites. Actually the percent of those successful ascents which failed to arrive was about 70% from ADA and 88% from the German sites -- substantially higher failure rates than the Moby Dick Hi duration and electro-mechanical failure rate experiences would have predicted. See Chapter III, Tab "H". (TS)

1. One approach to the trajectory problem is to assume that all balloons launched from a given site within 6 hours of a balloon (or balloons) which does arrive will move in essentially the same air mass as the arriving balloon (or balloons). The tabulation which follows was arrived at by considering each arrival (or the center launch if several launches in the same period arrived) and determining the total launches within ± 6 hours, the total successful ascents, and the total of that population which arrived.

Site	Balloons Considered	Launches ± 6 hours	Succ Ascents	Arrivals	%
ADA	16	83	31	45	55%
GAR	3	12	10	4	40%
EVA	1	9	8	1	13%
OBE	5	28	24	7	29%
GIE	6	30	21	10	48%
Total		167	144	67	46% (S)

Of the 399 successful ascents, 12 are known to have strayed and descended into neutral areas and 144 are included in the tabulation above. Without any implication that trajectory is an explanation for the failure of the remaining 243 to arrive, it is reasonable to conclude that trajectory duration is not the obvious explanation for failure among the population of 144. Yet slightly over half of the total of this population (and 3/5 with Adana omitted) failed to arrive and the percentage arriving from any one site is roughly inversely correlated with transit distance. Estimates of trajectory effect have been made from several approaches. The most pessimistic approach results in an estimate that approximately 30% of balloons launched would have travelled in such directions and at such speeds that after seven days aloft (the theoretical life of the balloon) they would be in areas from which recovery could not be effected. The subject is discussed further in Chapter IV, Part 7. (S)

3. Attrition. The maximum altitudes to be employed were limited by higher headquarters directive and the high-low profiles could not be used. Accordingly, duct modifications were made in order to regulate floating altitudes with a compromise limitation on ceilings forced by the duration believed needed. It was known before-hand that the altitudes were within the ceiling of Soviet combat aircraft and theoretical investigations had established

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firmly that the cross-bar and water pole were essentially tuned to Soviet-used frequencies and that the effective radar cross-section of the package was ample for radar visibility in the spectra of a large number of Soviet radars. War gaming in the early days of the project had indicated the essentiality of high volume launching at the outset in the hope of getting a number through before the Soviet could effectively react. This strategy was again limited by higher headquarters directive regulating the rate of launch and later by political considerations at Gerdemoen which effectively removed that site from action and simplified the Soviet force deployment problem. Essentially the only tactic left was in selection of time of launch at the German sites in order to maximize the dispersion and area of required activity for the Soviets. Another factor, now thought to be highly contributory to losses to aircraft, was revealed in the study of profiles of recovered balloons. See Chapter III, Tab "N", wherein it is revealed that balloons spent approximately 75% of their flight time at the ballasting (lowest) altitude, i.e., half the daylight hours and all the darkness hours. (TS)

1. That there was Soviet effective air activity against balloons is known. The contribution of Soviet activity to arrival failures is not known. However, using only the numerical data from this report and certain assumptions a broad band type of estimate can be made. (TS)

2. First, it is assumed that the duration curves derived from Moby Dick Hi are in the right ball park. This says in effect that duration is actually more marginal than had been anticipated and this has been essentially confirmed by the ballasting records of recovered vehicles. See Chapter III, Tab "N". (Ballast consumption was generally higher than theoretical, apparently due to high-altitude turbulence.) Assumed also are required mean durations of 72 hours from ADA, 120 from CBE and GIE, 130 from GAR and 150 from EVA. These have been adjusted upward slightly from the mean durations that were obtained from actual arrivals from the first three, and adjusted down from the single data points available from the remaining two sites. Tabulations follow:

Site	Mean Dur. Hrs	Req. (hrs)	Hrs to Prob. flying	Prob. flying	Prob. flying
		Turn-on	To Turn-on	To Mean Dur.	Turn-on To Dur.
ADA	72	50	.70	.65	.33
GAR	130	84	.62	.40	.63
EVA	150	90	.61	.17	.23
CBE	120	30	.63	.50	.63
GIE	120	30	.63	.50	.63

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Site	Number Succ. Ascents	Flying to turn-on Expected	Actual	Turn-on to Arrival Expected*	Actual
ADA	151	110	49	45	45
GAR	27	17	9	6	4
EVA	60	36	4	1	1
OBE	83	55	17	10	7
GIE	<u>73</u>	<u>46</u>	<u>22</u>	<u>14</u>	<u>10</u>
	399	264	101	76	67

*Based on actual "fixed".

(S)

3. The assumptions fit the turn-on to arrival data well enough if some allowance for instrumentation failure between turn-on and arrival is made and the real discrepancy occurs in the fit between the ascent and turn-on columns. Predictions based on the assumptions used indicate a natural cause loss of about 35% between ascent and turn-on. The actual apparent loss however, is about 75% indicating an attrition loss of about 60%. This, however, ignores the effect of instrumentation failure and adverse trajectories. The calculations for various assumptions yield the following: (S)

Natural loss	Assumptions Instrumentation	Trajectory effect	Attrition EST
35%	0%	0%	60%
35%	10%	0%	57%
35%	10%	10%	53%
35%	20%	0%	52%
35%	25%	0%	49%
35%	25%	10%	42%
35%	25%	30%	26%

(S)

The last represents the results of assumptions based on Moby Dick Hi data, and the worst trajectory effect calculated by our own Weather. It appears that if one does not accept an attrition assumption in the neighborhood of at least 45%, either the instrumentation failure rate, the trajectory effect, and/or the natural life of the balloon is much worse than any experience to date indicates. (S)

H. Termination and Recovery.

1. Of the 67 balloons arriving in the recovery area 57 were terminated by the following methods: (S)

Air	37
Ground	14
Self	2
Unknown	3
Friendly	
Fighter	1

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2. Air-to-air recoveries were successful in 16 cases of the 37 air terminations. Failures in air-to-air recovery and reasons for terminating flight of the other 21 vehicles were classified: (S)

Equipment failure	1 (failed to separate)
Drogue failed	3
Missed recovery	1
Darkness	15
Unknown	1
Total	<u>21</u>

(S)

3. In 12 of the 14 cases where ground termination was accomplished, darkness was the deciding factor. No reasons are stated for the other 2 cases. A recovery method tabulation follows:

Recoveries		
Air-to-air		16
Land:		
U.S. Army	1	
Air Rescue Service	3	
Jap Police	1	
Jap Nationals	<u>6</u>	
Water:		11
U. S. Navy	1	
Air Rescue Service	2	
Jap Coast Guard	1	
Jap Nationals	2	
Jap Maritime	2	
Jap Fishing Boats	<u>2</u>	
Total Recoveries		<u>17</u> 44

(S)

I. Summary:

1. Of 516 balloons launched 399 (77.5%) ascended successfully, 101 (19.4%) were tracked, 67 (12.9%) arrived, and 44 (8.5%) were recovered. (TS)

2. Adana was by far the most productive site, the German sites ranked next and Evanton was essentially non-productive. Gardemoen might have equalled the German sites in productivity, if political restrictions had not reduced it to about one-third of their launch activity. (TS)

3. The type 66 had a successful ascent rate of 79%, slightly lower than hoped for, and the late and early series 123 exhibited ascent success rates comparable to Moby Dick HI.

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performance, 81 and 43 % respectively. (S)

4. Duration was more marginal than planned on. (U)

5. Unless an attrition rate in the neighborhood of at least 45%, and essentially all of this in the first half of the transit, is accepted, assumptions re natural life-trajectory or instrumentation as factors contributing to failure to arrive and/or be heard violate all experience and best estimate. (S)

* "101 balloons fixed": In this analysis, a balloon which was "fixed" is defined as "a balloon on which one or more positions were established by radio bearings". In other sections of this report, it is stated that 123 balloons were "tracked", **which includes** the 101 "fixed", plus 22 from which transmissions were heard, and perhaps single bearings obtained, but not "fixed". In addition, 21 balloons transmitted termination signals which were not "fixed". This makes a total of 144 balloons "heard" in any manner.

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CHAPTER IV
METEOROLOGICAL
ASPECTS

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I. METEOROLOGY.

A. Introduction:

1. Meteorological considerations were involved to a large degree in both the long-range planning and day-by-day operational phases of the project. Long term climatological expectancies were employed to estimate the meteorological situation and plans were developed such that the favorable aspects could be exploited to the maximum and the unfavorable aspects minimized accordingly. Where possible, the day-by-day operations, or tactics, were ordered in light of the existing and forecast meteorological situation. Due to lack of essential current data and limitations on forecast capability, much of the day-to-day operation had to be based on climatological probabilities. (U)

B. Planning:

1. The area for meteorological planning was limited by the following consideration: (U)

a. The area over which operations were to be conducted was prescribed. (U)

b. The year and the season of the year during which operations were to be conducted was prescribed (November 1955 - April 1956). (C)

c. The number of vehicles to be employed was prescribed. (U)

d. The altitude range of the vehicles was 40-30,000 ft. (Ceiling was subsequently lowered to 55,000 ft by Air Staff order.) (S)

e. The maximum (theoretical) life of the 66CT vehicle was 10 days at initial altitude 41,500 feet with the requisite gross weights. For initial floating levels above 41,500 feet, 1 day of life had to be sacrificed for each 1,500 feet of altitude. The (theoretical) life of the 128TT vehicle was 3 days. (S)

f. There were no appreciable historical or day-to-day meteorological data over the greater part of the operational area at any level above 30,000 feet. Higher level conditions had to be estimated from lower level knowledge. (C)

2. Within the above limitations, answers were required for a large number of planning problems. Major problems are listed below accompanied by the answers, insofar as climatological analyses

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(discussed in greater detail in Part 1, this Chapter) could provide the answers. (U)

a. Based on the upper wind climatology,

- (1) Question: From what locations should balloons be launched such that maximum downstream coverage will be realized?
Answer: Western Europe and Asia Minor. (TS)
- (2) At what altitude should the balloons be flown such that the maximum number will enter, traverse, and emerge from the target area into a region where recovery may be effected within the lifetime of the balloons?
Answer: As low as system characteristics and vulnerability to unfriendly action will permit. (Best winds are in the altitude range 33-38,000 feet.) (TS)
- (3) Question: Where should recovery capability be located to effect maximum recovery?
Answer: Primarily in Japan. Back-up in Alaska-Aleutians to intercept escapees through the Japanese net or vehicles passing north of its northernmost limit. (TS)
- (4) Question: From derived mean (west) wind speeds at the selected mean operational altitude, how long after launch should the system HF/VHF transmitters be activated?
Answer: Mean travel times from Scotland, Norway, Germany, and Turkey are of the order $5\frac{1}{2}$, 5, $4\frac{1}{2}$, $3\frac{1}{2}$ days, respectively. To preclude the fastest travelling vehicles passing the recovery net while still silent, turn on times of 90, 84, 80, 50 hours after launch recommended. (TS)
- (5) Question: At various combinations of month-of-year, launch site, floating altitude(s), and balloon life, what percentage of balloons should be expected to successfully transit the area of interest?
Answer: For the ultimately selected operational months and altitudes, and for 7-8 days life, about 73%. By specific launch site: 90% from Turkey, 75% from Germany, 55% from Norway, and 70% from Scotland. (TS)

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b. Based on the surface and medium altitude climatology.

(1) Question: Within the general launch area dictated by the upper air currents, what sites have the highest expectancy of favorable launching weather?

Answer: The requirement to dispose launching sites normal to the prevailing winds (i.e. roughly north-south) and more or less equally spaced so as to provide maximum downstream coverage overrode surface weather considerations. Sites were selected wherever possible to the lee side of prominent terrain features. Favorable weather expectancies of 60%, 40%, 65%, 69% and 78% were computed for Oslo, Evanton, Giebelstadt, Oberpfaffenhofen, and Adana, respectively. (TS)

(2) Question: Within the general recovery area, which bases have the highest incidence of above-minimum terminal weather.

Answer: Availability of existing airfields precluded selection of operating locations on this basis. Above-minimum weather expectancies of 99.6%, 97.1%, 93.2%, 97.9%, 96.5% and 92.9% were computed for Kadena, Johnson, Misawa, Itazuke, Adak, and Kodiak, respectively. (S)

(3) Question: What is the expectancy of flying weather favorable for aerial recovery in the areas where balloons are expected to emerge from the continent?

Answer: Generally less than 70% over the northeastern Sea of Japan and over the north Pacific in a 600 mile wide belt along the 40°N parallel. Other-wise greater than 70%. (TS)

(4) As an index to the volume of usable reconnaissance which may be expected, what is the distribution of cloud cover over the area of interest?

Answer: In the order of 60-75% mean cloud cover over European Russia, NW Siberia, and the Maritime Provinces. Less than 50% in south-east Siberia. (TS)

3. Meteorological planning required the establishment of a weather observing and forecasting capability to support the project during the operation period. Details of the organizations involved, tasks, and technical guidance regarding the performance of duties are found in Parts 2, 3, 4 and 5, of this Chapter and in Annex "B" to IAD Operations Order 250-55. Briefly these are as follows: (U)

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a. A forecast section at the launch control center to predict initial (72 hour) forecast trajectories from each site, recommend optimum setting for the activation of reconnaissance devices, and compute "hindcast" trajectories. The lack of any upper air data at the operational levels over the area of interest plus the acknowledged limitations on forecast capability precluded selective launches based on predicted balloon trajectories. Some selectivity was obtained by restricting launchings to those periods when the initial forecast trajectory indicated balloons from Adana, the German sites, Gardermoen and Evanton would pass east of the 45°E meridian within 24, 60, 48, and 72 hours from launch, respectively. An analysis of the effectiveness of these criteria is found in Tab "10". (TS)

b. Weather advisory service at each launching detachment to predict surface weather conditions 24 hours into the future. (U)

c. A forecast section at the Recovery Control Center to prepare trajectory forecasts for balloons identified over the target area, area forecasts for in-flight aerial recovery operation, and, when necessary, flight forecasts for recovery operation. (TS)

d. Weather advisory service at each recovery squadron or subordinate unit to prepare recovery mission flight and local base terminal forecasts. (S)

e. Weather advisory service at Headquarters 1st Air Division commensurate with the scope of operational control exercised by the Commander, 1st Air Division. (U)

f. Organic radiosonde observation capability within each launching detachment to monitor balloon performance during launchings. (U)

C. Operations:

1. The following sequence of meteorological support actions took place during operations: (U)

a. At 1100Z daily the Commander, 1110th Air Support Group at the Launch Control Center reviewed trajectory forecasts (plots of predicted balloon positions at 12 hour intervals after launch) for each launch site. Two sets of forecasts were presented; one valid for launches from 1800Z that day until 0600Z the next day, and a second valid for launches from 0600Z-1800Z the next day. If the trajectories indicated penetration of the 45°E meridian within 24, 48, 60 or 72 hours from Adana, Gardermoen, the German sites, or Evanton, respectively, a "go" situation was announced for the particular site and period. If not, the Commander could still prescribe a "go" situation. Unless the forecast trajectory was unquestionably hopeless, he was expected to order at least one launch.

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Timer settings for the activation of cameras were prescribed on the basis of the predicted time of entry of vehicles behind the Iron Curtain. "Go/No Go" and setting instructions were issued to launch detachment commanders. Forecast trajectories and timer settings were transmitted via OP message to Headquarters, 1st Air Division. (TS)

b. Launch site commanders, after receiving instructions for the succeeding day's operations, consulted the local weather advisory service for a 24 hour prediction of surface weather conditions. A detailed launching schedule was established based in part on this forecast, but "stand-downs" were not ordered merely on the basis of a forecast of unfavorable weather. "Stand-bys", to take advantage of any unforecasted break in the weather, were ordered in such cases. (U)

c. When favorable weather conditions obtained, launchings were made as scheduled. A radiosonde AN/AMT 11, 403 mc, 1 watt, was attached to each balloon (not more frequently than 1 per 2 hrs) and monitored after launch by Radiosonde Receiver R 223, and the information of time vs pressure, temperature and relative humidity automatically recorded on Radiosonde Recorder AN/TMG-5. From these data, rate of ascent and height of level-off or burst were computed. All pertinent data on each launch were transmitted to the Launch Control Center and subsequently to Headquarters, 1st Air Division. (C)

d. "Hindcast" trajectory computations were prepared at the Launch Control Center from analysed upper air charts for each "cluster" of balloons from each launch site. This "flight following" continued for 72 hours from launch or until the vehicle passed the 80°E meridian, whichever was earlier. If these best-estimate balloon paths indicated erratic balloon travel over friendly areas, the Commander, Detachment 1, 1st Air Division, exercised the facilities available to him (shoot down by friendly aircraft) to terminate the balloon away from populated areas. "Hindcast" trajectory computations were furnished the Commander, 1st Air Division by OP message. (TS)

e. As soon as the first HF fix on an active balloon was plotted in the Recovery Control Center, a forecast trajectory for the vehicle and a flight path weather forecast were prepared. The Commander, 456th Troop Carrier Wing at the Recovery Control Center made plans to terminate and recover the vehicle based partly on this information. The recovery mission was assigned to a particular subordinate unit. In some cases, a specific flight forecast for the recovery mission was prepared at the Recovery Control Center and transmitted with the mission directive. (TS)

f. At the Troop Carrier Squadron or detachment air base, a specific flight forecast for the recovery mission was prepared. The forecast prepared by the Recovery Control Center, or general

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guidance issued in lieu thereof, was used to the extent necessary depending on the existing local forecast capability. (S)

g. In-flight weather observations were made at hourly intervals by recovery aircraft and transmitted to meteorological units. (U)

h. All fixes on active balloons and balloon terminations were transmitted to Headquarters, 1st Air Division by CP message. (C)

i. At Headquarters, 1st Air Division, a weather briefing was held daily at 1600Z. Weather conditions in the local, launch and recovery areas were discussed for the current Greenwich day using the 1230Z hemispheric prognostic surface chart as a briefing aid. Specific forecasts for launch and recovery bases were presented. Trajectory forecasts received from the Launch Control Center were entered on the 0300Z (next day) 200 mb prognostic chart and the major high level circulation features described. The Offutt Weather Central computed hindcast trajectories for 7 days after launch from carefully constructed daily 100 mb charts and furnished these data to the 1st Air Division Weather Division. Daily records of forecast and hindcast trajectories prepared by the Launch Control Center Weather Section plus comparable Offutt Weather Central hindcasts were maintained on small weather plotting charts. On these charts were plotted applicable balloon termination points and/or fixes at the time of last transmission to facilitate comparisons for computation accuracy. (TS)

D. Post-operation Analysis:

1. When the project was suspended on 6 February results were analysed to review planning accuracy and to revise if necessary plans for the conduct of subsequent operations. (C)

a. The disposition of launch and recovery facilities, area-wise, proved to be optimum for the project. Part 6, this Chapter indicates the typical trajectory patterns that were expected (from climatology) versus the theoretical paths that balloons would have taken (from hindcasts during the operational period) and the actual paths of certain recovered systems (from ACIC horizontal plots). (TS)

b. Vehicles were flown exclusively in the vertical region 40-55,000 feet. What the effect of different operational levels would have been cannot be stated categorically. (S)

c. The envelopes within which HF/VHF transmissions were expected to begin, based on the recommended transmitter actuation times, and the actual positions at which transmissions from operational vehicles were heard to commence, are shown pictorially and discussed

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in Part 3, Chapter II, of this Final Report. (S)

d. The effect of unfavorable trajectories could not be isolated precisely from other factors. Part I, this Chapter, estimates that, had all balloons survived for a period of 7 days, the following percentage could have been recovered. (S)

Predicted during planning period.
(assume equal number launched all
sites; launchings on all days)

OBE	ADA	GAR	EVA	GIE
75%	90%	55%	70%	75%

Theoretical results during operational
period. (based on actual numbers
launched on days launchings were made)

OBE	ADA	GAR	EVA	GIE
70%	90%	17%	51%	85%

Overall losses due to unfavorable trajectories were therefore predicted as 27%. Based on the theoretical results during the operational period, losses should have amounted to 29%. (TS)

e. A strict evaluation of the effect of surface weather at the launching sites on operations is not possible, as criteria used in the preliminary study were exceeded in actual operations due to the necessity for high volume launching. Based upon subjective estimates from Offutt Weather Central forecast data, the following comparison of actual operational time with the comparable climatological estimates is presented:

Climatological estimate

OBE	ADA	GAR	EVA	GIE
69%	78%	60%	40%	65%
70%	78%	55%	39%	62%

Estimate based on forecast
weather during operation

This evaluation is presented in greater detail in Part 8. (S)

f. A comparison between climatologically-predicted and actually experienced terminal weather at the recovery sites and flying weather in the recovery area is shown in Part 9, this Chapter. (S)

g. The reconnaissance product from the operation is insufficient to confirm or refute the coverage estimates made during the planning period. In computing these estimates, it was

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assumed that between 1/2 and 2/3 of all photography would be cloud photography. An analysis of usable photography versus cloud photography is discussed in Tab "K", Chapter III, this report. (TS)

E. Comments and Discussion:

1. In those areas of the operation in which the meteorological problem could be identified, and the impact of various meteorological conditions on the operation assessed, the application of climatology to the numerous planning problems has been eminently successful. In other areas, failure to recognize their existence and/or scope (or lack of the tools to deal with them), and thus to modify planning and tactics accordingly, may have appreciably detracted from the success of the project. (U)

a. Balloon launching:

- (1) Surface winds above 13 knots, actively occurring precipitation, and conditions favoring ice formation were considered, in planning, as restrictive to balloon launchings. In practice, launchings in precipitation and under icing conditions were made successfully. The failure rate may have been increased as a result of this practice. Results to date are inconclusive. (U)
- (2) Strain on balloon fabric allegedly increases with increasing upward velocity. The latter is a function of the buoyancy (free lift) of the balloon. At release, this value may be forecast. Variable and unpredictable radiative effects during ascent, however, may affect very greatly the buoyancy and hence the upward velocity. Lack of quantitative knowledge of what constitutes a critical ascent rate, plus lack of any means for pre-computing ascent rates during every stage of ascent, may have occasioned launches when such critical vertical velocities obtained and thus contributed to the failure rate. (U)
- (3) A corollary effect of high ascent rates is that the balloon may have sufficient momentum to pass through and well beyond its programmed initial altitude. Pressures inside the balloon become increasingly greater than those outside unless rapid valving of gas can occur, and proportionate strains are placed upon the balloon. (U)

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- (4) Turbulence associated with pronounced vertical wind shear during ascent allegedly puts considerable strain on balloon fabric. A critical value of 50 knots in 5,000 feet is recognized by General Mills. The gravitational shearing effect is known to create unstable Helmholtz-type waves in a quasi-horizontal flow which subsequently degenerate into closed vortices (eddies). The vortex axes are parallel to the upper flow under conditions of stable atmospheric stratification and normal to the flow with unstable stratification. Both may occur at the same time and same place, but at different altitudes. The existence of turbulence and the mechanism for producing it are thus established. Rawinsonde ascents nearest in time and space to instances of excessive balloon failures were examined for the existence of shear. No shears of the order deemed critical by General Mills were observed. Rapid temporal and spatial variations of wind velocity and shear are known to occur, however, and the lack of wind observations at each site synchronous with launches precludes elimination of shear turbulence as a contributing factor in balloon failures. (U)

b. Survival of balloons in accordance with pre-computed daily ballast expenditure. An analysis of the horizontal plots, vertical **profiles**, and photography from recovered balloons contained in Tab "A", Chapter III, suggests that departures of balloons from theoretical daylight floating levels have resulted in long and overballasting and over-valving of gas, both of which may have materially reduced balloon life. (TS)

- (1) Radiative effects. Profiles indicated that balloons descended, frequently to ballasting floor, when passing from open to cloud or snow-covered terrain. (U)
- (2) Excessive ascent rates at launch allegedly cause balloons to penetrate (due to their momentum) regions above the programmed initial altitude. (This effect is discussed in paragraph E1a above.) This will result in initial over-valving of gas and thus decrease balloon life. The lack of a rigid means for pre-computing ascent rates renders corrective action

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difficult at this time. (U)

- (3) Profiles indicated that balloons descended, frequently to ballast floors, after passing over mountain ranges (even small ones) oriented roughly normal to the direction of travel. (U)
- (4) Anomalous descents during daylight periods which could not be explained by radiative or mountain wave hypotheses may be the result of vertical motions caused by dynamic instability in the air currents themselves. The trigger action setting up this wave motion may occur many hundreds of miles upstream. (U)

c. Test programs conducted to date have failed to establish quantitative critical values which could be invoked in making "go/ no go" decisions, as pertains to the elements in paragraphs Ela(1), (2), (3) and (4) above. Until such values are determined, decisions must be based on subjective "judgement" and depending upon operational urgency. Data availability and forecast capability are inadequate to pre-determine, climatologically or on a forecast basis, the effect of the factors discussed in Elb(1), (2), (3) and (4) above. It would appear that to some extent, the "fix" may lie in increasing the vertical separation between daytime and ballasting levels. Thus, in view of the normally moderate rate of descent of balloons, counter-acting thermal and mechanical influence may be allowed time to come into play and reverse the direction of the vehicles before the necessity for ballasting occurs. (U)

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PART I

METEOROLOGICAL PLANNING

FOR OPERATIONS

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This Part was compiled and distributed to applicable subordinate and supporting units for information and guidance in September 1955. The grammatical composition, accordingly, is in the tense appropriate to the stage of operational planning which had been reached at that time.

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I. METEOROLOGICAL PLANNING FOR OPERATIONS

A. Introduction:

1. The development of a balloon reconnaissance program requires, first of all, a knowledge of the nature of the winds over the area to be reconnoitered. This knowledge is essential to enable selection of the optimum season of the year for operations, selection of the optimum altitude(s) for balloon flight, determination of **the best** areas from which to launch and recover, determination of optimum timer settings for the activation of balloon radio transmitters, and finally, estimation of the overall feasibility of the operation in terms of percentage of released balloons that will be recoverable. (S)

2. Secondly, it requires a knowledge of the climatology of the general launch and recovery areas so that the best spot locations, weather-wise, may be selected for the positioning of launch and recovery units. (S)

3. Thirdly, it requires a knowledge of the cloud climatology of the target area so that the number of balloon systems required to give adequate coverage may be known. (S)

4. Fourth, it requires the development of a weather observation and forecasting capability to support launching and recovery aspects of the reconnaissance operation. (S)

5. Prior to the time this organization was given the balloon reconnaissance mission, certain decisions as to the conduct of the operation had already been made. The season November-May was prescribed. The minimum balloon floating level was, for reasons of vulnerability, established at 40,000 feet. The balloon vehicle(s) available for the job had a ceiling(s) not above 80,000 feet. The climatology of the clouds over the target area had been studied and the requisite number of balloon systems determined. The area for planning was reduced accordingly. (TS)

B. Climatology of the Winds:

1. At the altitudes 40,000 - 30,000 feet over the target area there have been no upper air observations in past years. There is thus no direct evidence upon which to draw conclusions as to the behavior of the winds. A fair knowledge exists of the wind climatology at 30,000 feet and below. Relationships which have been derived between the winds at 30,000 feet and at various higher levels in regions

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where data availability makes such studies possible have been applied to mean, and in some cases daily, 30,000 foot charts of the target area and "best estimate" higher-level wind charts produced. Such charts have, of necessity, been the basis of wind studies upon which this operation is predicated. (S)

2. Air Weather Service Technical Report 105-128 contains charts of the mean January wind flow over Eurasia at 40,000 feet (200 mb). The flow is essentially west to east, though with a marked component toward the south. Confluence of the flow in the eastern portion is pronounced. The mean contours at 60°N and 37½°N over Northern Europe and Asia Minor, respectively, are found at 44°N and 34°N, respectively, at the eastern edge of Eurasia. Velocity maxima are pronounced in an east-west belt from 25°N to 30°N where average speeds are 80 knots - 120 knots. This "jet stream" curves toward the northeast near southern Japan and diverges into slower-moving currents directed toward the area south of the Aleutians and towards Midway Isle. A secondary and very much less pronounced maximum-wind belt is located at about 60°N in north-western Europe. Over most of Eurasia north of 43°N mean wind speeds are of the order 30 to 35 knots. (U)

3. Air Ministry Meteorological Research Paper 823, 4 Mar 54, contains a chart of the mean January flow at 53,000 feet (100 mb). Essentially the same pattern as above obtains, but the intensity of the flow is weaker than at 40,000 south of 55°N, and stronger than at 40,000 north of 55°N. In addition, this paper contains mean charts at 200 mb and 100 mb for April. Essentially the same pattern as for January obtains at the former level, although the intensity of the flow is only about 2/3 of its midwinter value. (U)

4. No mean charts at levels above 100 mb (53,000 feet) are available for Eurasia. Air Weather Service Technical Report 105-96, May 1953, contains charts of the 50 and 25 mb (67,000 feet and 83,000 feet) flow over North America and the gross features of these charts should be essentially the same as over Eurasia. Comparison of the mean 50 and 25 mb charts for January with their seasonal counterparts at 200 and 100 mb reveals that the same major patterns exist at all levels but that the intensity of the circulation grows steadily less with height at latitudes south of 55°N and steadily greater with height at latitudes north of 55°N. At latitude 40°N the winds average 30 knots at 200 mb, 55 knots at 100 mb, 25 knots at 50 mb and 25 knots at 25 mb. At latitude 70°N the winds average 40 knots at 200 mb, 55 knots at 100 mb, 90 knots at 50 mb, and 160 knots at 25 mb. (U)

5. Comparison of the mean 200 and 100 mb charts for April reveals that the 200 and 100 mb patterns are essentially the same, with the latter about 2/3 the intensity of the former. At 50 and 25 mb, however, the patterns are vastly different from those below.

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The charts show a very disorganized field of pressure with numerous weak closed lows and highs. (U)

C. Selection of Optimum Levels:

1. Except for the region north of 50°N, the strongest midwinter winds are at (or below) 200 mb (40,000 feet). As spring advances, the strongest winds are at this level regardless of latitude. Since balloon life is not unlimited, and the area to be reconnoitered is so vast, it would be desirable to operate the balloons at 40,000 feet. The vulnerability of balloons at this level is, however, at least worthy of concern. A compromise operation, involving the employment of a balloon which flies at its maximum ceiling (80,000 feet) to minimize detection possibility during the day, and at the lowest acceptable level (40,000 feet) to take advantage of the strongest winds at night, was originally planned. Recently developed modifications to this vehicle now permit it to be flown at any desired daytime level from 40,000 feet to 80,000 feet. Under current operational concepts it will be flown at 50, 55, 60, or 65,000 feet during daylight hours. (TS)

2. Tests of the balloon system designed to fly such a profile (128TT) have not been encouraging. An alternate vehicle (66CT) has been tested as a possible substitute. It flies at 39,000 feet at night and increases its daytime floating level by 1500 feet each day from an initial altitude of 41,500 feet to a maximum of 56 - 58,000 feet. (S)

3. Within the operational limits of available vehicles and limits imposed by vulnerability considerations, optimum levels have been chosen for balloon operations. (U)

D. Determination of Launch Area:

1. The prevailing wind flow (west to east) requires launching directly upwind of the target area. The component of the mean wind directed to the south requires that the launch area, if possible, be further to the north than the target area. The criticality of balloon life requires that launch sites be as close as possible to the western border of the target area, but not so close that balloons will penetrate neutral or target areas at such low altitudes that detection and interception probability is dangerously high. The parallelism of the wind field requires that the launch site complex be oriented normal to the prevailing wind (i.e., N-S) and that individual sites be well spaced to provide maximum downstream coverage. (S)

2. The initial requirement has been met. The launch area extends from northern Europe to Asia Minor. The second requirement

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has for astronomical, meteorological, political, and logistic reasons, not been met. To have done so would have required the establishment of launching sites in northern Scandinavia and Spitzbergen. The political and logistic considerations are beyond the scope of this paper. Astronomically, much of the region downstream from these areas is almost completely dark in winter and little useful reconnaissance would be obtained. Meteorologically, such sites would have very infrequent occurrences of the type of weather required for successful balloon launches. (TS)

3. With one exception the third requirement has been met. Political and logistic considerations dictated the utilization of a site in Scotland. The fourth requirement, slightly compromised due again to political and logistical expediencies, has also been met. (S)

E. Determination of Recovery Area:

1. The gross features of the wind climatology at and above 200 mb (40,000 feet) over Eurasia indicates that the bulk of balloons released in western Europe and Asia Minor between latitudes 60°N and $37\frac{1}{2}^{\circ}\text{N}$ should emerge from eastern Asia between 44°N and 34°N . The recovery effort should therefore be greatest in these latitudes, off the east Asian coast. Half the recovery capability is so disposed, at Kadena (Okinawa), Johnson, and Misawa Air Bases. (TS)

2. The subsequent mean path of the major air current over Japan diverges into ~~two~~ primary streams; one directed toward the area south of the Aleutians and the other toward Midway Island. The intensity of this current over Japan is such that a considerable number of balloons may pass into, through, and out of the operational range of Japan-based recovery aircraft during a bad weather period or even during a single night. A recovery capability is therefore needed downstream from the primary area to capture such escapees. Recovery units, accordingly, have been positioned at Adak and Kodiak, and an alternate recovery site selected at Midway. (TS)

3. A recommendation has been made that the recovery unit programmed for Central Air Base (Iwo Jima) be relocated in Japan. It does not appear that the alternate recovery site programmed for Clark will be utilized to any great extent. (TS)

F. Timer Settings for Activation of HF Transmitter:

1. Individual travel times (in days) from launch to emergence off the east coast of Asia were tabulated from computed trajectories at 50 mb (119L system with unmodified 128TT balloons) and 200 mb (66CT balloons) furnished by Headquarters Air Weather Service. Means were computed and are presented below. Figures in

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parentheses are interpolated or extrapolated values based on the seasonal variations of the intensity of the winds, or represent adjusted values where the actual data appeared strongly biased due to the smallness of the sample. (TS)

Launch Site	Balloon	Dec	Jan	Feb	Mar	Apr
	Profile					
Evanton	66	5.3	(5)	5.4	(6)	6.5
	128	(9)	7.9	9.1	(9.3)	9.5
Gardermoen	66	5.2	(5)	5.4	(5.7)	6.1
	128	(7.5)	5.3	8.9	(9.5)	(10)
Giebelstadt and Oberpfaffenhofen	66	4.4	(4.4)	4.9	(5.4)	5.9
	128	(7.5)	(7.5)	8.4	(9)	(9.5)
Adana	66	3.3	(3.4)	3.4	(4)	4.7
	128	(6)	4.9	5.9	(7.5)	9.6

2. 128TT balloons modified to fly at 50 - 55,000 feet by day should travel at the same (mean) rate as the series 66CT balloon. When modified to fly at 65,000 feet by day the travel time will be the same as if they were flying at 80,000 feet since the intensity of the flow is comparable at the two levels. Interpolation between the above values will give mean travel times when the balloon is modified to fly at intermediate daytime levels. (TS)

G. Feasibility of the Operation:

1. Numerous studies have been made to estimate the feasibility of the operation in terms of percentage of released balloons which will be recoverable. The studies have also endeavored to indicate where the balloons will be recoverable and thus to recommend optimum areas for the positioning of recovery facilities. It is to be expected that, in view of the dearth of observational wind data, the findings of different investigators would be at variance. This has indeed proved to be the case. (C)

2. System 119L (Balloon Type 128TT - Unmodified):

a. Solot and Darling, "Climatological Investigation of System 119L", (Secret), December 1954, computed mean winds and standard vector deviations from 40,000 feet - 80,000 feet by

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latitude and altitude over Europe for the season December to February and assumed this climatology persisted downstream over Asia. The subsequent statistical trajectory computations showed the following percentage expectancy of balloon recoverability within discrete latitude belts along a line just off the coast of east Asia (from 30°N 130°E to 55°N 165°E): (S)

Recovery Zone (°Lat)	LAUNCH SITE GERMANY						LAUNCH SITE TURKEY					
	Average Balloon Life (Days)						Average Balloon Life (Days)					
	7	8	9	10	11	12	7	8	9	10	11	12
55-50	2	3	4	5	6	6	2	4	5	6	6	6
50-45	1	2	3	4	5	6	2	3	4	5	6	6
45-40	1	1	2	3	4	5	1	2	3	4	5	6
40-35	$\frac{1}{2}$	1	2	2	3	4	1	2	4	5	6	6
35-30	$\frac{1}{2}$	1	2	2	3	4	2	2	4	5	6	6
N of 55												
S of 30	3	4	5	6	6	6	3	4	5	5	5	5
Total	8	12	18	22	27	31	11	17	25	30	34	35

The study is subject to four qualifications:

- (1) The values of west-wind speed determined by these investigators is generally less than that determined by several other investigators. The expectancies are probably accordingly too low. (U)
- (2) Account was not taken of the component of the mean west wind directed to the south. Expectancies are probably too high in the northern latitudes and too low in the middle latitudes. (U)
- (3) The season studied is mid-winter; the time of highest speed west winds. The winds abate as spring advances. When applied to an operation extending through April, the expectancies are probably too high. (U)
- (4) The lower floating level is presumed to be 50,000 feet instead of 40,000 feet. Winds are weaker at the higher level. Expectancies are probably too low. (U)

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Criticisms 1 and 4 tend to cancel number 3. The totals are probably somewhat conservative and the middle latitudes should have higher recovery expectancies. (U)

b. Headquarters Air Weather Service, "Selected Trajectory Probability", June 1955, (with Addendum) plotted individual trajectories at 50 mb (67,000 feet) from daily charts of that level for the months January, February, and April 1953. These charts were prepared (using extrapolation techniques) by the United States Weather Bureau and comprise the only series in existence of day-to-day maps at any level above 200 mb over Eurasia. It was discovered that, for the period under study, a large number of balloon trajectories diverged from the path indicated by the "mean" wind and passed over the Polar Basin into the western hemisphere. For this reason arbitrary "recovery lines" over northern Greenland and Canada were postulated and recovery expectancies computed along these lines. Recovery zones are identified below: (S)

Zone I 25° - 32°N along 125°E.

Zone II 32°N - 35°N along 125°E and then from 35°N 125°E to 45°N 150°E.

Zone III 45°N 150°E to 55°N 175°E.

Zone IV 75°N 10°W to 85°N 110°W.

Zone V 85°N 110°W to 75°N 130°W.

Recovery expectancies, percentage-wise, are expressed in the following table:

LAUNCHINGS IN JANUARY-FEBRUARY FROM:

Recovery Zone °Lat.	OSLO			FRANKFURT			U. K.		
	Avg Balloon Life			Avg Balloon Life			Avg Balloon Life		
	7	2	9	7	8	9	7	8	9
45-55 (Zone III)	7	7	9	5	5	5	9	14	14
32-45 (Zone II)	21	25	28	24	29	33	12	19	24
25-32 (Zone I)	0	0	0	2	2	3	3	3	7
<u>TOTAL (E Asia)</u>	<u>28</u>	<u>35</u>	<u>37</u>	<u>31</u>	<u>36</u>	<u>41</u>	<u>24</u>	<u>36</u>	<u>45</u>
Zone IV	45	45	47	22	26	28	16	17	17

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	ANKARA		
	Avg Balloon Life		
	7	8	9
Recovery Zone °Lat.			
45-55 (Zone III)	9	9	9
32-45 (Zone II)	50	50	50
25-32 (Zone I)	14	14	14
TOTAL (E Asia)	73	73	73
Zone IV	16	17	19

LAUNCHINGS IN APRIL FROM:

	OSLO			FRANKFURT			U. K.		
	Avg Balloon Life			Avg Balloon Life			Avg Balloon Life		
	7	8	9	7	8	9	7	8	9
Recovery Zone °Lat.									
45-55	5	5	5	0	0	0	0	0	5
30-45	0	0	0	0	5	5	0	0	10
25-32	0	0	0	0	0	0	0	0	0
TOTAL (E Asia)	5	5	5	0	5	5	0	0	15
ZONE IV	45	45	45	35	35	35	45	45	45
ZONE V	30	30	30	15	20	20	20	25	25

	ANKARA		
	Avg Balloon Life		
	7	8	9
Recovery Zone °Lat.			
45-55	0	0	5
30-45	0	5	10
25-32	0	0	0
TOTAL (E Asia)	0	5	15
ZONE IV	15	15	20
ZONE V	5	10	10

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The recoverability off the east coast of Asia of 7-day balloons from all launch sites in January - February is $\frac{28+31+24+73}{4} = 39\%$.

In April it is $\frac{5}{4} = 1.2\%$. For the season December - April it is approximately $\frac{39+39+39+20+1}{5} = 28\%$. A startling and controversial

result of the Air Weather Service study was the finding that such a relatively large number of (theoretical) balloons strayed into and beyond the polar region. The possibility of recovering these balloons was at once considered but the following weaknesses in the study were serious enough to restrain modification of the existing concept of operations until additional evidence came to hand: (S)

- (1) The period studied (3 months of 1 year) is too short from which to draw firm conclusions. (U)
- (2) The period studied was definitely anomalous in a direction favorable for a high percentage of trans-polar trajectories. (U)
- (3) The 50 mb (67,000 feet) flow is not necessarily representative of a mean between the flow at 80,000 feet and 40,000 feet. It is much more like the flow at 80,000 feet than it is the flow at 40,000 feet. (U)
- (4) The 50 mb charts were not constructed from observed data but were extrapolated up from 300 and 500 mb data with (probable) resulting inaccuracy of considerable magnitude. (U)
- (5) Balloon trajectories do not follow contours or streamlines exactly. The method used in computing the trajectories has been demonstrated to have a "built-in" error of 20% of total path length in the determination of end points. (U)

c. To sum up, the results of the two studies discussed above indicate that an overall recovery expectancy of 10 - 28% could be realized for the operating season from all launch sites. If the operation could be compressed into the mid-winter period, this figure would rise considerably. (U)

3. System 119L (Balloon Type 66CT):

a. The study produced by Solot and Darling contains the following percentage expectancy of balloon recoverability off

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the east coast of Asia for a vehicle flying at 55,000 feet during the day and at 45,000 feet during the night: (S)

Recovery Zone (°Lat)	<u>LAUNCH SITE-GERMANY</u>						<u>LAUNCH SITE-TURKEY</u>					
	Avg Life of Balloons(Days)						Avg Life of Balloons(Days)					
	7	8	9	10	11	12	7	8	9	10	11	12
55-50	3	4	5	6	6	6	4	5	5	6	6	6
50-45	2	3	4	5	5	6	3	4	5	6	6	6
45-40	2	2	4	4	5	6	2	4	4	5	6	6
40-35	2	3	4	5	5	6	3	4	5	6	6	6
35-30	2	3	4	4	5	5	4	4	5	6	6	6
N of 55,S of 30	4	5	6	6	6	6	4	4	4	5	5	5
TOTAL	15	20	27	30	32	35	20	25	28	34	35	35

It is seen (referring to the figures derived under the same assumptions for the 128TT balloon), that changing the profile doubles the recoverability (for a 7-day balloon). If, in addition, a 10-day life for the 66 balloon is assumed, recoverability is trebled. (S)

b. Headquarters Air Weather Service (Preliminary Report on Selected Trajectory Probability, May 1955 and August 1955) has prepared statistical studies of 200 mb (39,000 feet) and 100 mb (53,000 feet) trajectories using methods similar to Solot and Darling's but taking account of longitudinal variations of the mean wind and its standard vector deviation rather than assuming a zonal climatology. A judicious average of the expectancies of the two levels should be representative of the type 66 balloon expectancy and is presented below: (For 10-day balloons) (S)

Recovery Zone Lat	<u>LAUNCHES FROM:</u>							
	Adana		Frankfurt		Glasgow		Oslo	
	Jan	Apr	Jan	Apr	Jan	Apr	Jan	Apr
45-55°N	12	17	15	15	17	11	26	5
32-45°N	36	36	26	24	36	10	31	10
25-32°N	15	10	9	7	6	1	4	1
TOTAL	63	63	50	46	59	22	61	16

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No statistical study was made by Air Weather Service for the 128TT balloon profile, so comparison (as was done in the section above) is difficult. Comparison of these figures with those obtained by Solot for similar levels is possible and is presented below: (S)

Total % Recoverability in 10 Days from:

	Frankfurt	Adana
Per Solot	30	34
Per Air Weather Service Study	48	63

The drop-off in recoverability of balloons from Glasgow and Oslo is pronounced as the winds weaken with the coming of Spring. (S)

c. A sample of 103 individual trajectories at 200 mb (40,000 feet) from the launch site complex covering the period December - April and for the years 1949 - 1952 was computed by Headquarters Air Weather Service. A rough degradation factor was applied to account for the progressive daily ascent of the balloon into lighter wind fields. The percentage recoverability within indicated latitude increments, same recovery line and zones as for previous study, is indicated below (10-day balloon life). (S)

Launchings December-April from:

Latitude	Oslo	Frankfurt	Evanton	Adana
45-55	30	22	30	8
32-45	48	67	55	41
25-32	0	0	0	44
TOTAL	78	87	85	93
Zone IV	7	0	4	0
Zone V	4	4	0	0

The percentage of balloons which would be recoverable near the polar region (Zones IV and V) is seen to be much less than those expected with the higher-flying balloon. The mean recoverability in all latitudes off East Asia is $\frac{78 + 87 + 85 + 93}{4} = \frac{343}{4} = 86\%$.

This value is almost exactly three times the figure of 28% predicted by the 50 mb (67,000 feet) trajectory study for the 128 profile. Thus there is a remarkably good agreement between the Solot and

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Air Weather Service figures as regards relative-recovery efficiency of the two systems although the former investigator predicts absolute recoverabilities only 1/3 as great as the latter for both systems. (S)

4. A summing-up of the overall seasonal feasibility is shown in the following table: (S)

Comparison of Recoverability Expectancies from All
Launch Sites

Recovery between 25°N and 55°N Off Coast of East
Asia, December-April

	128TT Balloon Profile (7 days life)	66CT Balloon Profile (10 days life)
Solot and Darling (Statistical Method)	9.5	32
Air Weather Service (Direct method; 50 mb Trajectories for 128TT, 200 mb Trajectories for 66CT)	28	86
Air Weather Service (Statistical Method)		47
Average, all investigations	19% for System 119L(Unmodified) 55% for System 66	

Modification of the 128TT balloon to fly at a daytime level of 65,000 instead of 80,000 will not affect recoverability appreciably as the winds at 65,000 feet are comparable in intensity with those at 80,000 feet. Modification of the 128TT to fly at 50 - 55,000 feet by day will give recoverability essentially the same as the series 66 balloon. Modification to 55 - 65,000 feet daytime levels will give intermediate recoverability values. (S)

H. Selection of Launch Sites:

1. The disposition of the launch site complex is primarily dictated by the climatology of the upper winds, as has been discussed. Within the general framework of this disposition, specific launch sites can be selected which have, relatively, the highest frequency of favorable launching weather (no

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precipitation and surface winds less than 13 knots). Political and logistical considerations have precluded selection of (meteorologically) ideal sites, but within those limitations, optimum sites have been chosen. The choices of Evanton over Prestwick, Gardermoen over Sola, and Oberpfaffenhofen and Giebelstadt over sites in the French and British zones of Germany are in consequence of their more sheltered aspects with respect to the prevailing westerly winds and hence lower expectancy of high winds and precipitation. (C)

2. Climatological expectancies at the several launch sites are presented in the following tables: (U)

a. Gardermoen:	Dec	Jan	Feb	Mar	Apr
Days/month with precipitation greater than .05 or surface winds greater than 15K ("non-operational")	13	12	11	14	10
Mean daily max temp (°F)	29	28	30	38	48
Mean daily min temp (°F)	24	21	21	26	34
b. Evanton:	Dec	Jan	Feb	Mar	Apr
Days/month with precipitation greater than .05 or surface winds greater than 15K ("non-operational")	19	19	16	20	18
Mean Daily max temp (°F)	44	44	44	47	51
Mean daily min temp (°F)	35	35	35	35	37

Percentage of total number of days, November - April, with simultaneous occurrence of surface winds less than 13 knots, precipitation less than .05, average surface-to-tropopause lapse rate less than 2.7° C/1000, and no icing; within indicated increments of mean west-component wind between 40,000 feet and 80,000 feet:

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0 - 10 Knots	8%
11 - 25 Knots	14%
26 - 45 Knots	14%
Over 45 Knots	<u>4%</u>

Total	40%
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c. Adana:	Dec	Jan	Feb	Mar	Apr
Days with precip (Rain, no snow)	10	11	10	9	8
Mean daily max temp (°F)	62	57	60	66	74
Mean daily min temp (°F)	43	39	41	45	51
Days with thunderstorms	2	3	3	2	3
Days with frost	.5	1.75	.75	.25	0

Percentage frequency of winds from direction indicated:

N	17	19	15	14	11
NE	35	28	22	15	12
Calm	37	41	49	48	45
All Other	11	12	14	13	17
			/SW/	10	15

Winds greater than 12 knots occur 20.4% of the time.

d. Oberpfaffenhofen:	Dec	Jan	Feb	Mar	Apr
Days with precip (Rain, no snow)	13	12	11	13	15
Days with snow	6	6	5	4	1
Days with snow cover	10	11	6	3	1

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d. Oberpfaffenhofen (Cont'd)

	Dec	Jan	Feb	Mar	Apr
Mean daily max temp (°F)	36	33	37	46	54
Mean daily min temp (°F)	26	23	25	31	37
Days with fog	10	9	8	6	5

Winds - December-February: From South West quadrant
about 35% of the time.
From North East quadrant
about 25% of the time.
From all other directions
5% of the time. Calm about
35% of the time.
Speed 5 - 10 knots about
35% of the time.
Speed 11 - 15 knots about
15% of the time.
Speed 15 knots about 15%
of the time.

March-April: From South West quadrant
about 50% of the time.
From North East quadrant
about 30% of the time.
Calm about 20% of the time.
Speed 5 - 10 knots about
35% of the time.
Speed 11 - 15 knots about
15% of the time.
Speed 15 knots about 30%
of the time.

Note: Precipitation is mostly of the light, steady type;
most commonly during the night and forenoon hours.

e. Giebelstadt:	Dec	Jan	Feb	Mar	Apr
Days with precip (Rain or snow)	14	12	13	12	13
Days with snow	6	6	5	3	1
Days with snow cover	10	14	12	8	1

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e. Giebelstadt (Cont'd)

	Dec	Jan	Feb	Mar	Apr
Mean daily max temp (°F)	39	37	40	49	58
Mean daily min temp (°F)	30	26	27	33	39

Winds - December-February: From South West quadrant
about 40% of the time.
From North East quadrant
about 15% of the time.
Calm about 20% of the time.
Speed averages 10 - 12 knots.

March-April: From South West quadrant
about 35% of the time.
From all other directions
about 45% of the time.
Calm about 20% of the time.
Speed averages 8 - 16 knots.

I. Selection of Recovery Sites:

1. The selection of recovery sites has had to be made primarily in consequence of the expected balloon trajectories and governed by the existing availability of air bases. There has been little chance for the selection of one location over others based on the expectancy of operational flying weather. As a matter of interest, the expectancy of Contact, Instrument, and Below Minimum weather at the several recovery bases is presented in the following tables: (S)

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	Dec			Jan			Feb			Mar			Apr		
	C	N	X	C	N	X	C	N	X	C	N	X	C	N	X
Kodiak	96.7	8.4	4.9	85.6	8.8	5.6	80.8	9.9	9.2	82.8	9.8	7.4	84.1	11.3	4.6
Adak	86.5	10.7	2.8	85.7	10.9	3.4	84.2	12.2	3.6	85.5	11.0	3.5	84.7	12.7	2.6
Misawa	88.9	5.0	6.0	84.5	8.5	7.0	85.5	8.0	6.5	90.6	4.7	4.7	88.9	7.7	3.3
Johnson	88.9	8.5	2.6	91.6	6.1	2.3	89.6	6.5	3.9	91.2	6.8	2.0	88.4	8.6	3.0
Kadena	95.7	3.7	0.6	97.2	2.4	0.3	96.0	3.6	0.4	94.0	4.9	1.0	89.2	8.4	2.3
Iwo Jima	95.0	3.7	1.3	94.1	2.5	3.5	96.7	2.1	1.2	95.2	3.3	1.5	83.8	9.3	6.9
Clark	98.0	1.0	1.0	99.9	0.1	0.0	100	0	0	99.8	0.1	0.1	99.6	0.3	0.1
Midway	97.8	1.1	0.1	98.4	1.4	0.1	98.0	1.9	0.1	98.8	1.0	0.1	97.8	1.8	0.4

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J. Recovery Area Weather:

1. Aerial interception, cut-down, and recovery of balloons requires essentially VFR weather at location, level, and time in question. The frequency with which such conditions obtain at levels 12 - 18,000 feet is shown in inclosure 1. (TS)

K. Coverage Considerations:

1. The trajectories that will be followed by the balloons, their height, the cloud cover below the balloon, relative length of daylight/darkness periods, and the number of reconnaissance sorties will determine the degree of photographic coverage to be obtained. Conversely, if the trajectories and cloud cover are given, the number of balloons required to give any degree of coverage may be computed. (TS)

2. A study prepared by Air Weather Service (Upper Air Trajectories Over Europe and Asia, April 1951, T.S.) indicates the frequency with which balloon trajectories at 200 mb originating in Northern Scotland during the winter season may be expected to traverse discrete block areas 5 degrees of latitude by 10 degrees of longitude in size. The results are shown in inclosure 2. Percentages in any one longitudinal strip add up to over 100% since certain trajectories penetrate two or more latitudinal belts within the same longitudinal zone. (S)

3. The mean cloudiness over the target area is shown in inclosure 3. (U)

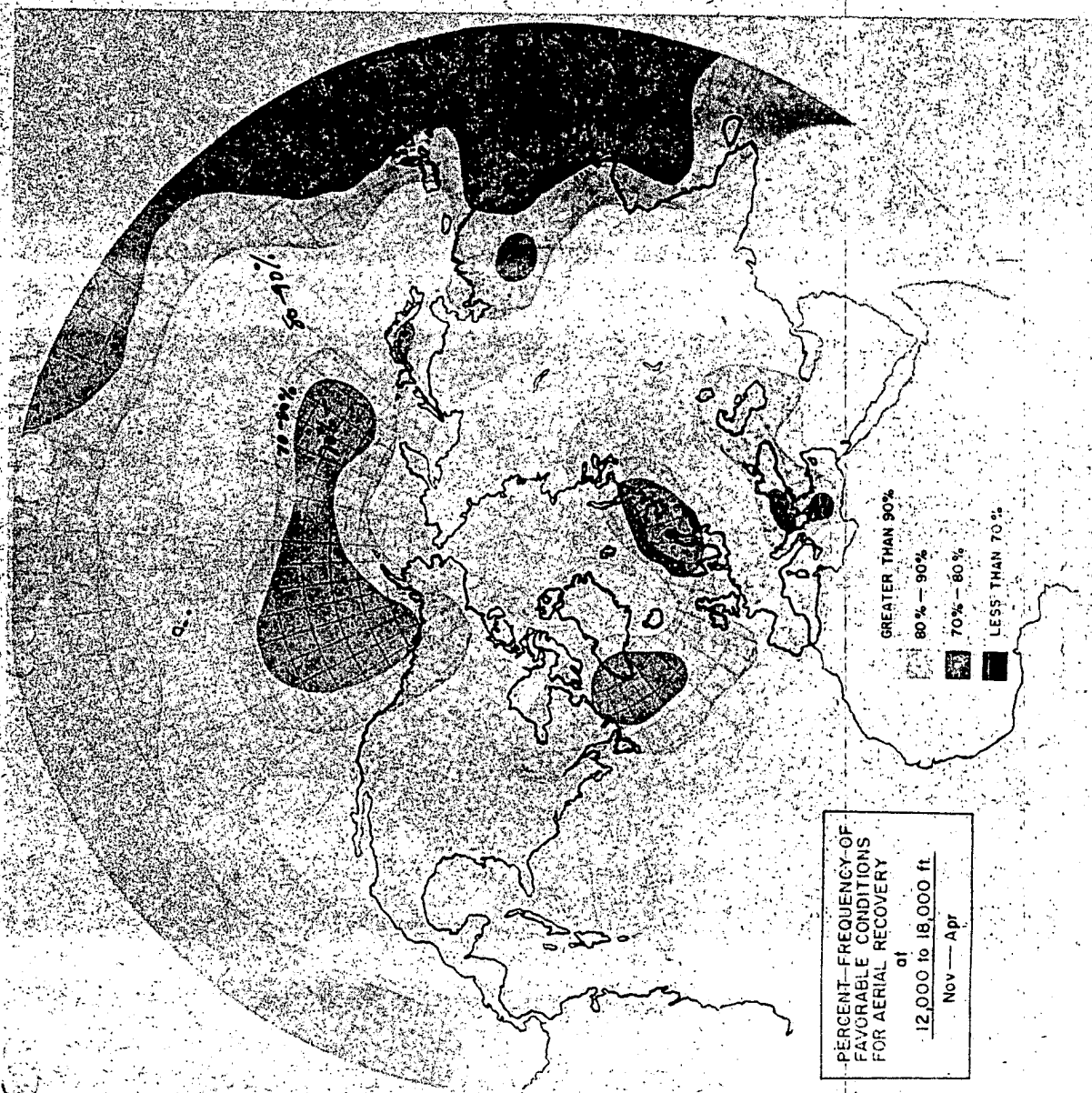
4. From the 1951 trajectory and cloudiness statistics, and after applying degradation factors for various causes, 2500 balloon sorties were calculated by a Rand Corporation study (1953) to give 80% coverage. The curve, balloon sorties (abscissa) vs % coverage (ordinate) is very steep to the coordinates 2500 and 80%. Beyond this point it becomes relatively flat indicating very many more balloon sorties would be required to give relatively little more coverage. Estimates based upon more recent trajectory studies indicate approximately 68% coverage will be achieved. (TS)

L. Operational Meteorological Support:

Essential weather observing and forecasting requirements were outlined in the weather annex to 1st Air Division Operations Plan 250-55 and discussed in detail in parts 2 and 3 this chapter. (U)

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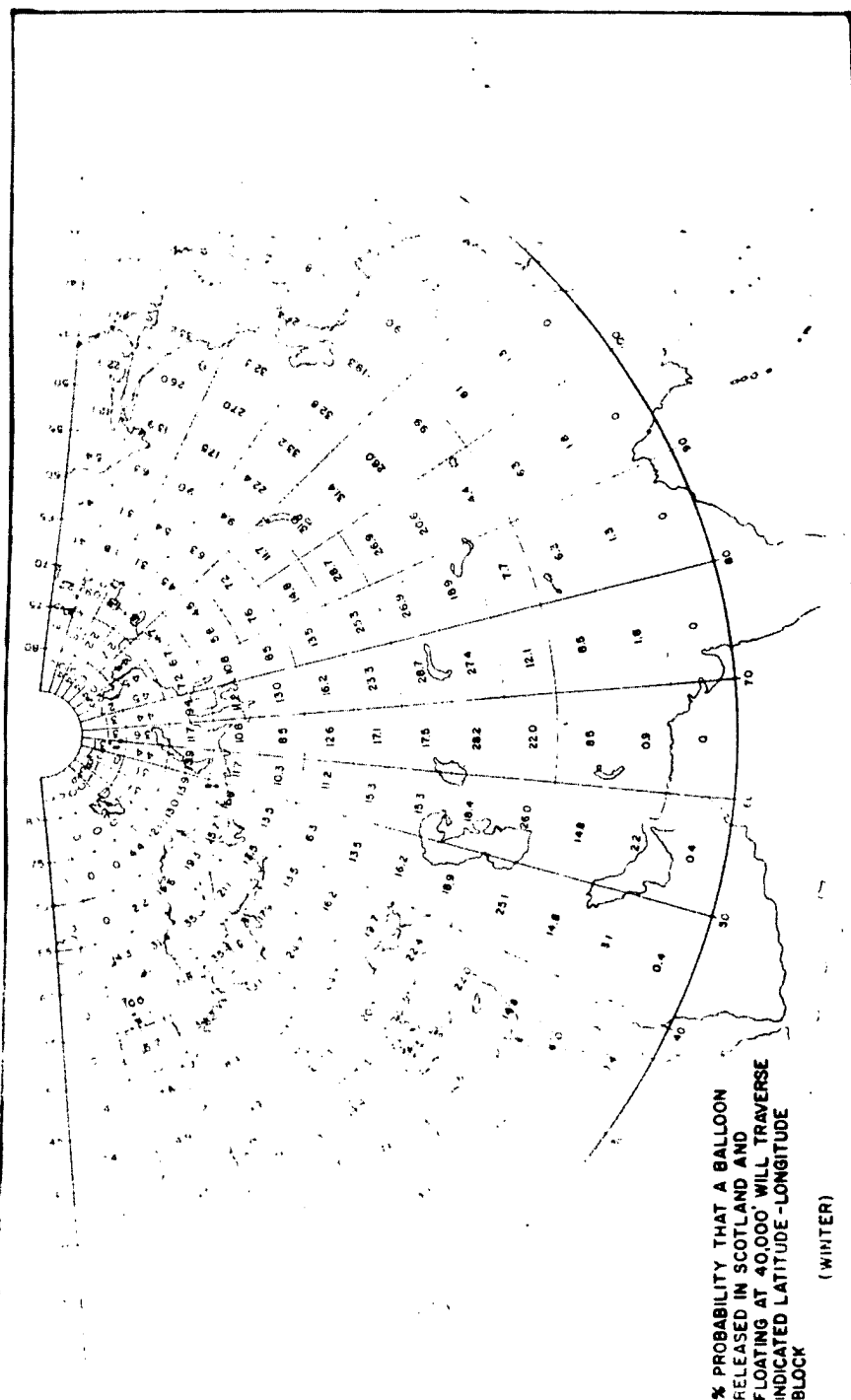
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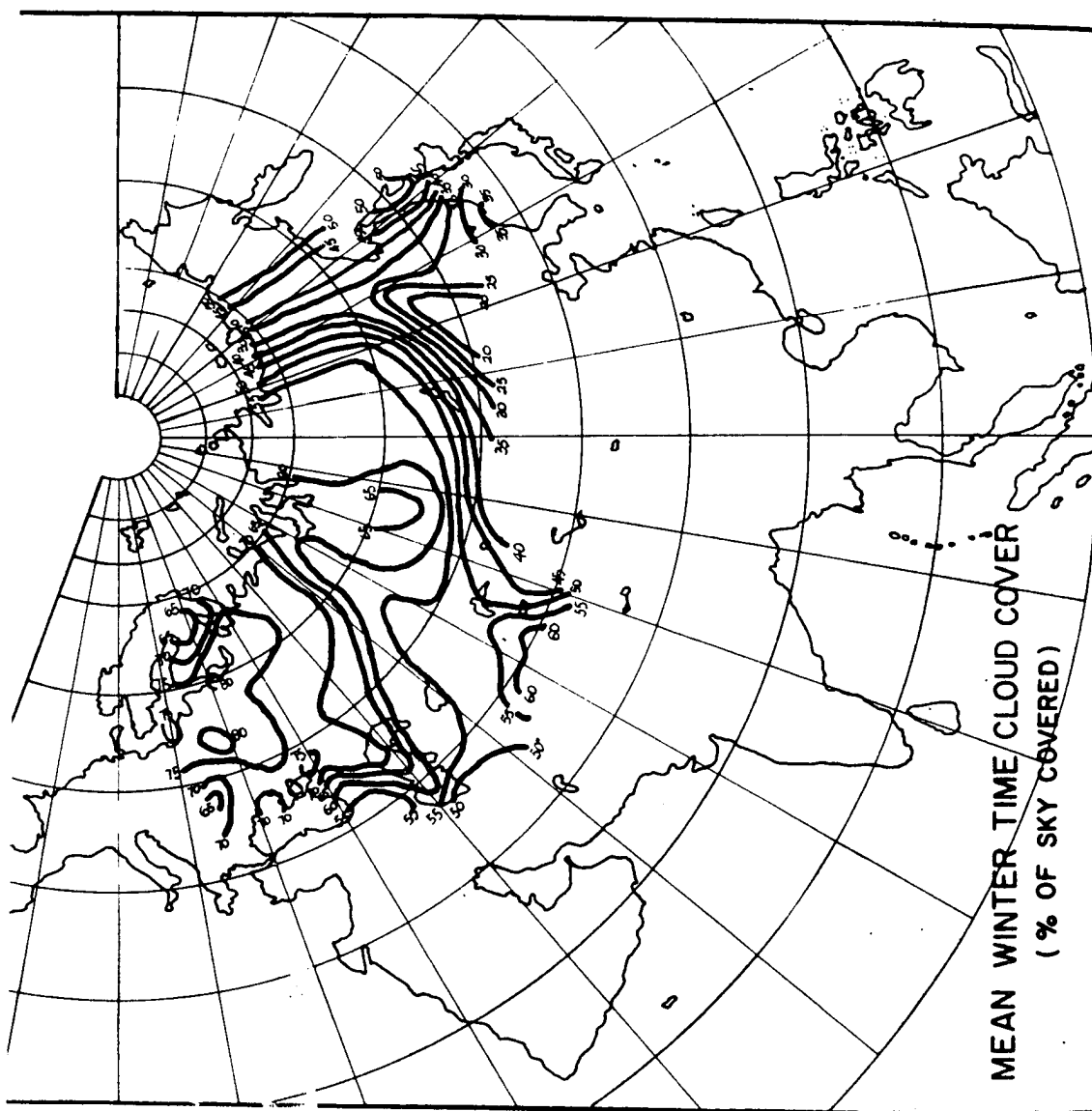
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PART II

GUIDANCE FOR OPERATION OF LAUNCH

CONTROL CENTER WEATHER FACILITY

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This Part was compiled and distributed to applicable subordinate and supporting units for information and guidance in September, 1955. The grammatical composition, accordingly, is in the tense appropriate to the stage of operational planning which had been reached at that time.

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I. GUIDANCE FOR OPERATION OF LAUNCH CONTROL CENTER WEATHER FACILITY

A. Mission: Within the scope of appropriate portions of the Weather Annex to 1st Air Division Operations Plan 250-55, provide the Launch Control Center and launch detachments with meteorological information, trajectory forecasts, weather forecasts, and advisory service to the degree that will enable launching operations to be planned and executed in the most efficient manner possible. (C)

B. Requirements: The nature of the operation requires essentially the following:

1. Predict the paths that balloons proposed to be released from launching sites would follow during the 48 hour period subsequent to scheduled launch to determine whether balloons will or will not travel to desired areas and thus to recommend whether or not to launch. From predicted trajectories, recommend optimum timer settings for the activation of reconnaissance devices. (S)

2. Predict the times and places at which launches should be made, such that subsequent trajectories will carry balloons to pre-determined places at pre-determined times. (U)

3. Predict the local march of weather at the launching sites so that plans may be made to exploit to the maximum periods of favorable weather and to minimize the effects of unfavorable weather. (U)

4. Supervise the radiosonde observation program to insure that timely and accurate information is being obtained and that this information is being utilized to maximum advantage in launching operations. (U)

C. Discussion of Requirements:

1. Trajectory Forecasts: Two balloon systems will probably be employed, each with a different flight profile. Depending on pre-flight modification, the L28TT balloon will ascend to 50, 55, 60 or 65,000 feet at launch and remain at that level until the next (local apparent) sunset (at the level in question). It will then descend to 40,000 feet and remain there until the next (local apparent) sunrise (at 40,000 feet) at which time it will rise to its previous day's floating level plus 1,500 feet. This night/day profile will continue throughout the life of the balloon. The periods of time involved in ascending/descending appear to be about as long as those when the balloon is at the upper/lower floating level; also numerous departures from the above "idealized" profile will occur due to unpredictable radiative influences.

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Because of these uncertainties, reasonable accuracy in trajectory prediction should be achieved by assuming that balloon travel will be determined by the flow at 100 mb (53,000 feet), 75 mb (60,000 feet), or 50 mb (67,000 feet) for the time beginning when it first reaches (approximately) these altitudes until the following sunset and for each subsequent sunrise-to-sunset period; and by the flow at 200 mb (39,000 feet) for each sunset-sunrise period. These, and all subsequent references in this memorandum to noon, sunrise, and sunset are to local apparent noon, sunrise, or sunset. (S)

2. The 66CT balloon will ascend to 41,500 feet at launch and remain at that level until the next sunset (at 41,500 feet). It will then descend to 39,000 feet and remain there until the next sunrise (at 39,000 feet). It will then ascend to 43,000 feet, remain at that level while the sun is shining on it, and return to 39,000 feet after sunset. This night/day profile, 39,000 feet during hours when no sun is shining on it and an increase of 1,500 feet of altitude with each day of life (to a maximum of 56-58,000 feet) during hours when the sun is shining on it, will continue throughout the life of the balloon. Uncertainties in the profile due to unpredictable radiative influences and the small vertical separation between night and day floating levels during the first days of life indicate that reasonable accuracy in trajectory prediction should be achieved by assuming that balloon travel will be determined primarily by the flow at 200 mb (39,000 feet) through its first two days of life. (S)

3. To compute trajectories for the 128TT balloon, it is necessary to know the number of hours, and which hours, the balloon will be at each of its floating levels. By reference to sunrise/sunset tables for the appropriate month, altitude, and latitude, **the number of** hours prior to/subsequent to local noon that sunrise/sunset, respectively, occur may be determined. The local apparent sunrise/sunset times may be converted to Greenwich by subtracting one hour for each 15 degrees of longitude that the point in question is east of the Greenwich Meridian. Finally, it is necessary to have prognostic contour charts at the levels in question and valid for the times in question. (S)

4. Noon, roughly in the mid-portion of the launch area, occurs at 1100Z; midnight at 2300Z. Within reasonable limits of accuracy the 100, 75, or 50 mb prog valid at 1500Z and the 200 mb prog valid at 0300Z should serve as adequate representations of the flow at the 128TT levels during daylight and darkness hours, respectively. The time required for data collection, plotting, and analysis, is such that "latest" analyses are not satisfactory for trajectory work; all prediction must be done from progs, although the lack of forecasting ability at levels above 100 mb, in effect, probably makes the latest analyses of such surfaces

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the best progs for up to 48 hours. The basic charts, therefore, which must be on hand at all times for 128TT trajectory prediction are as follows:

Latest 50 mb analysis

Latest 75 mb analysis (Obtained by graphical averaging
100 mb and 50 mb charts)

100 mb prog valid 1500Z current day

200 mb prog valid 0300Z next day

100 mb prog valid 1500Z next day

200 mb prog valid 0300Z next subsequent day

With the necessary prognostic charts, sunrise-sunset tables and conversion chart (Greenwich to local time), trajectories may be computed as follows: (U)

a. Assume a planned 128TT balloon release from Adana at 0800Z, 15 January 1956, initial floating level 55,000 feet. (S)

- (1) Local time at Adana = Z time plus 2 hours. Balloon takes approximately 1 hour to reach floating level. Thus initial point on trajectory will be for 0900Z (1100 local time). Initial point position will be at a point 1 hour x mean vector wind 0-55,000 feet over Adana. (S)
- (2) Balloon will remain at this level until next sunset. Overlay 100 mb prog valid 1500Z with acetate. Reference acetate to map coordinates. Plot initial position of balloon at 1100L (0900Z). Move balloon with indicated 100 mb flow for 18-11 = 7 hours as a first approximation. Note latitude and longitude. (U)
- (3) Consult sunset table for 55,000 feet for latitude and date in question. Note number of hours subsequent to local noon that sun sets at 55,000 feet. Add this to 1200 to get local sunset time. Convert this to Greenwich time at the longitude in question. Compute difference in hours between this time and initial point time (0900Z) to get number of hours' travel at the 55,000 foot level. Recompute first segment of trajectory, moving balloon a

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distance = hours' travel x indicated wind speed in the direction of flow. Mark position and time (Z) of balloon. Remove acetate. (U)

- (4) Overlay acetate on 200 mb prog valid 0300Z and reference to appropriate coordinates. Move balloon a distance = 12 hours x indicated wind speed in the direction of flow as a first approximation. Note latitude and longitude. (U)
- (5) Consult sunrise table for 40,000 feet for latitude and date in question. Note number of hours prior to local noon that sun rises at 40,000 feet. Subtract this from 1200 to get time of local sunrise. Convert this to Greenwich time at the longitude in question. Compute difference in hours between this time and time of previous position of balloon to get number of hours' travel at the 40,000 foot level. Recompute second segment of trajectory, moving balloon a distance = hour's travel x indicated wind speed in the direction of flow. Mark position and time (Z) of balloon. (U)

5. The trajectory computation proceeds in this fashion for successive daylight/darkness periods for as long as necessary. Each segment computation involves a first approximation to get the approximate end point coordinates and then a recomputation based on the actual number of hours of daylight/darkness involved. (U)

6. The prediction of series 66CT balloon trajectories can be done entirely at the 200 mb level and does not involve computation of daylight/darkness periods. A variety of methods may be used. (U)

a. Central Tendency Method: Prognostic charts of the 200 mb surface valid for successive instants of time 12 hours apart and (each) presumed representative of the flow for a period 6 hours before and 6 hours after the "as of" time is used. The prog nearest in time to the instant the balloon reaches floating altitude is overlain with acetate and the acetate referenced to map coordinates. From its initial position, the balloon is moved with the geostrophic wind in a direction parallel to the contours (assumed coincident with streamlines) a distance $S = vt$, where v = geostrophic wind speed and t = number of hours between the valid time of the prog plus 6 hours, and the time the balloon reaches floating altitude. After the initial segment of the trajectory is drawn, the acetate is withdrawn, placed over the prog valid for the next 12 hour period, referenced to coordinates, and the balloon is moved a distance equal to the indicated geostrophic wind x 12 hours in the direction of the contours. The trajectory computation proceeds in successive 12 hour steps for as long as necessary. The following 200 mb progs

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must be on hand to enable 48 hour trajectory computation. (U)

12 hour prog valid 0300Z (1500Z)

24 hour prog valid 1500Z (0300Z)

36 hour prog valid 0300Z (1500Z)

48 hour prog valid 1500Z (0300Z)

60 hour prog valid 0300Z (1500Z)

b. General Mills Standard Objective Method: This method is based on pure extrapolation of the 200 mb flow pattern as analyzed from most recent data, assuming that the analyzed flow pattern will exhibit no change of shape or intensity and will translate eastward (or westward) with the same speed as was observed to occur, on the average, during the preceding 24 hours. In the construction of the trajectory, which is done on a transparent overlay, the translation is performed in six hourly increments. (U)

- (1) An "ascent vector" is computed from the last available wind soundings to forecast the position of the balloon at the time (say T) when it will have reached floating level. The flow pattern is then translated to the position it is forecast to have at T + 3 hours. (U)
- (2) The trajectory for the period T to T + 6 hours is constructed by assuming that for this six hour period the balloon moves with the wind speeds and directions given by the map at time T + 3. The flow pattern is then translated to its forecast T + 9 position and the trajectory for the period T + 6 to T + 12 is obtained in a similar manner. The operation is repeated as many additional times as is necessary. (U)
- (3) In practice, translation of the flow pattern is accomplished by displacing the overlay in a direction opposite to the movement of the pattern. (U)
- (4) In this procedure, slight discontinuities of direction may be observed where the six hour legs join. These are smoothed out in the final trajectory prediction. (U)

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c. Methods Involving Computation of Trajectory Path Segments for Short-time Periods and Their Correction for Contour Curvature and Acceleration:

Considerably more refined methods of trajectory computation have recently been devised (Wobus, Franceschini and Freeman, and others) which have proven quite accurate when applied to "hindcast" computation. Whether those methods are superior to the simpler Central Tendency and General Mills techniques in forecast computation has not been established. The magnitude of the error inherent in the construction of prognostic charts is probably too great (for periods in excess of 24 hours) to justify the operational use of these more elegant methods. It is possible that special instances will arise where maximum accuracy is essential. It is planned to test the relative accuracy of the several trajectory techniques for 24-48-hour path prediction. If significantly greater accuracy is shown by any one technique, a full description of the method and recommendations for its employment will be issued by this headquarters. (U)

d. "Reverse" Trajectory Forecasts: In some instances it may be desirable that a balloon arrive at a particular point at a fixed time, or that an array of balloons arrive at a particular line at a fixed time. The trajectory computation, worked in reverse beginning with the prog chart valid for the desired time of arrival will give the optimum place and time for launch. A series of reverse trajectories, worked backwards from a set of points along a given line will give the different times at which balloons should be released from the launch site complex, although some interpolation will usually be required since the release points are fixed geographically. (U)

e. Local Terminal Weather: Although the operation, as planned, calls for continuous readiness to release at the maximum rate whenever favorable weather conditions obtain, there will undoubtedly be instances (imminent shortages of supplies, requirements for maintenance of equipment involving its withdrawal from operations, etc) when an accurate forecast of terminal conditions will enable plans to be made for essential curtailment of operations/expansion of operations to the absolute maximum, which will contribute to the overall efficiency of the operation. (U)

f. Radiosonde Observations: Radiosonde observations are required for two primary purposes:

- (1) As telemetering data to give height of "level-off" or height of burst, if burst occurs, when visual observation is impossible. (U)

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- (2) In conjunction with "black-ball" soundings, to give a measurement of the existing differential between ambient air temperature and black-body temperature throughout the vertical. This differential, suitably adjusted for existing cloud cover, is a function of the excess/deficit of freelift at various altitudes relative to measured freelift at release. Entering appropriate tables with this value, recommended values of "weigh-off" freelift may be obtained which will insure ascent rates slower than the "critical" (on one side) and great enough to prevent trapping of the balloon in a stable layer of the atmosphere (on the other). A "critical" ascent rate has not yet been established nor has the "black ball" procedure been included in operational SOPs. Utilization of radiosonde data for the purpose above must await these developments. (U)

g. Secondary Purposes are:

- (1) To lend credence to the "cover" plan (i.e., meteorological research). (S)
- (2) To provide supplemental upper-air observations for the use of meteorological agencies rendering operational weather support to the project. (U)

D. Operational Use of Weather Information: In practice, it should usually be sufficient for planning purposes to compute 48-hour trajectories from each of the launching sites every 12 hours; preferably for assumed releases at 0900Z and 2100Z. Based upon these forecasts, the Launch Control Center Commander will change, if necessary, "go/no-go" instructions in force at that time for each of the launch sites; and will direct the modification, if necessary, of existing timer settings for the activation of camera and electronic equipment. (S)

1. A briefing on the current and forecast broad-scale weather situation over the entire launch area and on the expected weather conditions at each launch site should be presented to the Launch Control Center Commander twice daily, or as frequently as he may desire. Elements of particular concern are precipitation, surface winds, and icing at the surface and aloft. (U)

2. A summary of each general launch area briefing, plus appropriate launch site terminal forecasts should be transmitted to the launching sites for the information of the Launching Detachment Commander and for such planning as may be within his scope. (U)

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PART III

GUIDANCE FOR OPERATION OF RECOVERY

CONTROL CENTER WEATHER FACILITY

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This Part was compiled and distributed to applicable subordinate and supporting units for information and guidance in September, 1955. The grammatical composition, accordingly, is in the tense appropriate to the stage of operational planning which had been reached at that time.

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I. GUIDANCE FOR OPERATION OF RECOVERY CONTROL CENTER WEATHER FACILITY

A. Mission: Within the scope of appropriate portions of the Weather Annex to 1st Air Division Operations Plan 250-55, provide to the Recovery Control Center and to recovery units, meteorological and oceanographic information, trajectory forecasts, weather forecasts, and advisory service to the degree that will enable recovery operations to be planned and executed in the safest and most efficient manner possible. (S)

B. Requirements: The nature of the operation requires essentially the following:

1. Predict the paths that balloons identified as flying in the recovery area will follow, so that recovery aircraft may be directed to the proper points for interception. (S)

2. Predict the weather along these paths so that the optimum points (weather-wise) may be selected for cut-down and recovery. (S)

3. Predict terminal weather at the recovery aircraft bases and alternates so that the operability (weather-wise) of these bases will be known. (S)

4. Predict any weather phenomena in the recovery area which would be restrictive to penetration by C-119 aircraft at medium altitudes. (U)

5. After decisions have been made, in light of the above factors (and others) of the times, places, and recovery units when, where, and by whom respectively, recoveries are to be effected, prepare necessary flight forecasts. (U)

6. After operations are in progress, met-watch winds, planned recovery point weather, terminal weather, and movement and development of severe storms so that operations may be cancelled/ altered to advantage, as necessary. (U)

C. Discussion of Requirements:

1. Trajectory Prediction.

a. Two balloon systems will probably be employed, each with a different flight profile. The 128TT balloon will be flying at 50, 55, 60, or 65,000 feet (depending upon modifications performed on it prior to launch) when the sun is shining on it, and at approximately 40,000 feet when the sun is not. It appears that the periods of time involved in ascending or descending are

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about as long as the periods during which it remains at the upper or lower floating altitude. Numerous departures from the above "idealized" profile will occur due to unpredictable radiative influences. (S)

b. The 66CT balloon will be flying at approximately 50,000 feet when the sun is shining on it (by its 5th-6th day of travel when it is expected to enter the recovery area). Actually it begins its travel at 41,500 feet and gains 1,500 feet of altitude each succeeding day to a maximum of 56-58,000 feet. It flies at 39,000 feet when the sun is not shining on it, throughout its life. (S)

c. To compute trajectories, it is essential to know the type of balloon and thus the levels which must be forecast. It is also necessary to know the number of hours, and which hours, the balloon will be at either level. By reference to sunrise/sunset tables for the appropriate month, altitude, and latitude, the number of hours prior to local apparent noon and subsequent to local noon, that sunrise and sunset, respectively, occur may be determined. (All subsequent references in this memorandum to local noon, sunset, or sunrise are to local apparent noon, sunrise, and sunset). The local sunrise/sunset times may be converted to Greenwich times by adding one hour for each 15° of longitude that the point in question is west of the Greenwich Meridian. Finally it is necessary to have prognostic contour charts at the levels in question and valid for the times in question. (U)

d. Since balloons may be expected to depart rather radically at times from programmed profiles, it is considered that reasonable accuracy may be achieved by considering that their motion is determined primarily by (for the 128TT balloon) the daytime flow at 100 mb (53,000 feet) 75 mb (60,000 feet) or 50 mb (67,000 feet) and the night-time flow at 200 mb (39,000 feet); and (for the 66CT balloon) the daytime flow at 100 mb (53,000 feet) and the night-time flow at 200 mb (39,000 feet). (S)

e. Local noon at longitude 135°E occurs at 0300Z; local midnight at 1500Z. Prog charts of the 50, 75 and 100 mb surfaces valid at 03Z should therefore serve as adequate representation of the flow at the balloon levels during daylight hours. Prog charts of the 200 mb surface, valid at 1500Z, should be representative of the flow at the balloon level during night-time hours. The time required for data collection, processing, analysis, and chart distribution is such that latest analyses are not satisfactory for trajectory work; all prediction must be done from progs. The "current" chart will therefore be a 12 hour prog. Since forecasts for up to 48 hours in the future are required, 24 and 48 hour progs from the "as of" time of the 12 hour prog must be on hand. Since no forecasting skill has been developed at levels above 100 mb, the latest

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analyses of these surfaces must serve as "prognoses" for up to 48 hours. (S)

f. At any time during the period 09Z-21Z (essentially the local night-time) that a 48 hour trajectory must be computed, the following charts must be on hand: (U)

- (1) 200 mb prog valid 1500Z that day
100 mb prog valid 0300Z subsequent day
200 mb prog valid 1500Z subsequent day
100 mb prog valid 0300Z next subsequent day
200 mb prog valid 1500Z next subsequent day
Latest 50 mb analysis
Latest 75 mb analysis (obtained by graphically averaging 50 and 100 mb charts) (U)

g. At any time during the period 21Z-09Z (essentially the local daytime) that a 48 hour trajectory must be computed, the following charts must be on hand: (U)

- 100 mb prog valid 0300Z that day
200 mb prog valid 1500Z that day
100 mb prog valid 0300Z subsequent day
200 mb prog valid 1500Z subsequent day
100 mb prog valid 0300Z next subsequent day
Latest 50 mb analysis
Latest 75 mb analysis (U)

h. With the prognostic charts, sunrise-sunset tables, and a conversion chart from local to Greenwich time, trajectories may be computed as in the following example: (S)

Given: Balloon type 66CT
Time of latest fix 25 Jan 0600Z
Location of fix 40°N - 105°E

- (1) It is first necessary to determine the altitude of the balloon. Referring to the time conversion chart, local time at 105°E is 0600 - 17 hours = 1300. The balloon is thus at its daytime level, about 50,000 feet and should remain there for approximately 5 hours. (U)
- (2) Consult the 100 mb prog chart valid for 0300Z. Overlay with acetate, mark coordinates, plot initial position of balloon. Move balloon with indicated flow for five hours as a first approximation. Note latitude and longitude. (U)
- (3) Consult sunrise/sunset table for latitude,

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altitude, and date in question. Note number of hour subsequent to local noon that sun sets at 50,000. Add this to 1200 to get local sunset. Convert to Greenwich time at the longitude in question. Compute difference in hours between fix and sunset to get actual number of hours travel involved. Recompute first segment of trajectory, moving balloon a distance = hours of sunlight travel X indicated wind speed in direction of flow. Mark position of balloon and time (Z). Remove acetate. (U)

- (4) Overlay acetate on 200 mb prog valid 1500Z and reference it to appropriate coordinates. Move balloon with indicated flow for 12 hours, as a first approximation. Note latitude and longitude. (U)
- (5) Consult sunrise table at 40,000 for latitude and date in question. Note number of hours prior to local noon that the sun rises at 40,000 feet. Subtract this from 12 to get local sunrise. Convert this to Greenwich time at the longitude in question. Compute number of hours between previous position and sunrise. This gives the number of hours the balloon has been in darkness. Recompute second segment of trajectory, moving balloon a distance = hours of darkness X indicated wind speed in the direction of flow. Mark position and time (Z) of balloon. Remove acetate. (U)

1. The trajectory computation proceeds in this fashion for successive darkness/daylight periods for as long a time as necessary. Each step involves a first approximation to get the approximate coordinates at the next ascent/descent period and the trajectory segment is then shortened or lengthened depending upon the actual length of the daylight or darkness period. Forecasts for the 128TT balloons when at 60-65,000 feet are the same except that the latest 50 or 75 mb chart is used instead of successive 100 mb progs during daylight periods. (U)

2. Prediction of Weather Along Trajectories. A time-series of prognostic interpretation (nickname PRIN) charts covering the entire recovery area and valid for discrete times twelve hours apart, is recommended as the basic tool for path-weather prediction. PRIN charts delineate areas of homogeneous weather and describe in detail the nature of that weather. The disposition of sensible weather phenomena (clouds including amount, type, base and top:

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precipitation including rain, snow, hail, drizzle, fog, and special phenomena such as thunder storms, turbulence, and icing) is analyzed from the latest synoptic chart, aircraft reports, etc; and inferred from upper level charts, radiosonde ascents, sferics, etc. The PRIN chart consists of this disposition, modified as it is expected to be at a specific later time based upon forecast movement and development of fronts, and major features of the circulation (highs, lows, troughs, ridges); time of day, nature of underlying terrain, etc. Forecasts for points along the predicted trajectory, synchronous with "as of" times of the PRIN charts, are thus given direct; weather intermediate between these points in time and space is interpolated. The presentation of trajectory weather can be accomplished by means of a flight cross-section along the trajectory. (U)

3. Prediction of Terminal Weather. This information should be provided by the weather units at the recovery and alternate bases in the form of 24 hour TAFORS, TFAWS, etc. The forecasts should be checked for consistency with expected developments in the large-scale synoptic picture and displayed for reference. (U)

4. Severe Weather. Weather restrictive to in-flight operation (typhoons and other severe storms) should be followed closely and operations personnel kept advised of the areas affected or to be affected, and of the intensity of the weather at all times. Major weather agencies usually issue frequent bulletins on the nature and travel of such storms. (U)

5. Flight Forecasts. Weather sections at recovery bases may not have facilities to prepare as detailed and accurate flight forecasts as will the Recovery Control Center Weather Section. Moreover, it is essential that weather planning information furnished the Recovery Control Center Commander, and that furnished operational personnel at the recovery bases, be consistent. For these reasons, a flight forecast will always be furnished with the recovery mission directive message. Flight forecasts, with the exception of flight winds, may be made from the PRIN charts, modified as necessary by late information not available at the time the PRIN was prepared. FIFCR code is recommended for transmission of forecasts. Wind forecasts will be required for levels near 700 mb (10,000 feet) along most of the route and up to 500 mb at the recovery point. A 700 mb contour and isotherm prog time-series is recommended as the basic forecast tool. Winds at levels to 5,000 feet above and below this elevation may be reasonably extrapolated from the contour-isotherm relationship (AWS-WPC Form 10-4). (U)

6. Met-Watch. A close watch on the weather developments occurring over areas where, and at time when active operations are in progress, or imminent, is essential. This follow-up to the issuance of forecasts requires close surveillance of in-flight reports, intermediate-hour FIFAL and RAWIN reports, hourly weather from recovery

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bases and from reporting stations in areas where operations are in progress, and late bulletins pertaining to severe storms. ... complicated visual aids for the display of this information are a "must" if it is to serve its purpose. Displays of current vs. forecast weather are particularly useful in revealing trends toward unfore-casted developments. (U)

7. Basic Data Required by Recovery Control Center Weather Section.

a. Constant-pressure analyses and progs required for trajectory prognosis are itemized in the section pertaining to trajectories. PRIM charts (for the preparation of balloon trajectory path-weather and flight forecasts) for the "current" time (actually a 12 hour prog), and prognostics for 12 and 24 hours in the future, are required. A "current" (12 hour prog) 700 mb chart (with isotherms) plus prognostics for 12 and 24 hours therefrom are required for flight wind forecasts. The above charts are considered the "minimum essential" and should be augmented by such other facsimile charts and progs as are routinely transmitted by the Tokyo Weather Central for non-specialized weather activities. A recommended schedule for the reception of these charts at the Recovery Control Center Weather Section follows: (U)

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TIME (Z)	LOCAL	200 mb PROG	100 mb PROG	HIGH LEVEL ANALYSES	700 mb	PRIN
00	09	24 hr prog fr 15Z val. 15Z this day				
01	10		36 hr prog fr 15Z val. 03Z next day			
02	11	48 hr prog fr 15Z valid 15Z next day	60 hr prog fr 15Z val. 03Z 2 days hence			
03	12					
04	13					
05	14					
06	15					
07	16					
08	17					
09	18	12 hr prog fr 03Z valid 15Z (09-21Z) this day				
10	19					

12 hr prog fr
03Z val. 15Z
this day
24 hr prog fr
03Z val. 03Z
next day

12 hr prog
fr 00Z val.
12Z this
day
24 hr prog
fr 00Z val.
00Z next
day
36 hr prog
fr 00Z val.
12Z next
day

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TIME(Z)	Cont'd	LOCAL	200 mb PROG	100 mb PROG	HIGH LEVEL ANALYSES	700 mb	PRIN
11		20			50 & 75 mb analyses for 03Z	36 hr prog fr 03Z valid 15Z next day	
12		21		24 hr prog fr 03Z valid 03Z next day			
13		22	36 hr prog fr 03Z valid 15Z next day				
14		23		48 hr prog fr 03Z valid 03Z 2 dys hence			
15		24	60 hr prog fr 03Z valid 15Z 2 dys hence				
16		01					
17		02					
18		03					12 hr prog fr 12Z valid 00Z next day
19		04					24 hr prog fr 12Z valid 12Z next day
20		05					36 hr prog fr 12Z valid 00Z next sub-sequent day
21		06		12 hr prog fr 15Z valid 03Z next day			12 hr prog fr 15Z valid 03Z next day
22		07					24 hr prog fr 15Z next day
23		08			50 & 75 mb analyses for 15Z	36 hr prog fr 15Z valid 03Z next subsequent day	

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b. The following "raw data" and "processed data" are required in the Recovery Control Center Weather Section to permit last-minute modification to operational forecasts and for essential met-watch activities: (U)

- (1) All typhoon and severe storm advisories.
- (2) All PIBAL/RAWIN reports.
- (3) All aircraft weather reports (PCMAR, SACMAR, RECCO, PIREPS).
- (4) 24-hour terminal forecasts (TAFORS/TEAMS) from all recovery bases and for other important terminals in the FEAF-Alaskan area.
- (5) Latest surface weather reports (AERO, SYNCOP, etc) from above stations.

c. Oceanographic data and forecasts should be secured from the U. S. Navy Weather Central through the Tokyo Central on a routine or request basis as required. (U)

d. Climatological studies, extended period forecasts (over 72 hours in the future) and meteorological advisories beyond the capabilities of the Recovery Control Center Weather Section should be secured from the Tokyo Weather Central. (U)

3. Operational Use of Weather Information.

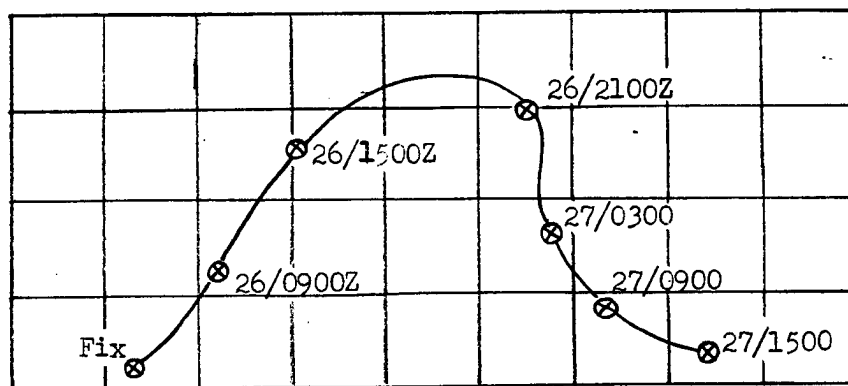
a. The Recovery Control Center Commander must have at hand forecast balloon trajectories, "flight forecasts" along these trajectories, recovery base terminal weather forecasts, and "severe weather" area forecasts to enable him to make necessary operational decisions. (S)

b. Balloon trajectory and "flight weather" forecasts should be prepared as soon as possible following notification of the first fix on a "new" balloon, and routinely every 12 hours on all active balloons as soon as possible after reception of the latest facsimile charts and based on the most recent fixes. Separate forecasts will normally be required on each balloon. A recommended form on which this information can be presented to the Recovery Control Center Commander is as follows. It consists of two parts; a mercator grid which can be identified by appropriate coordinates and upon which the forecast trajectory is plotted, and a flight cross-section depicting the forecast weather along the trajectory. (S)

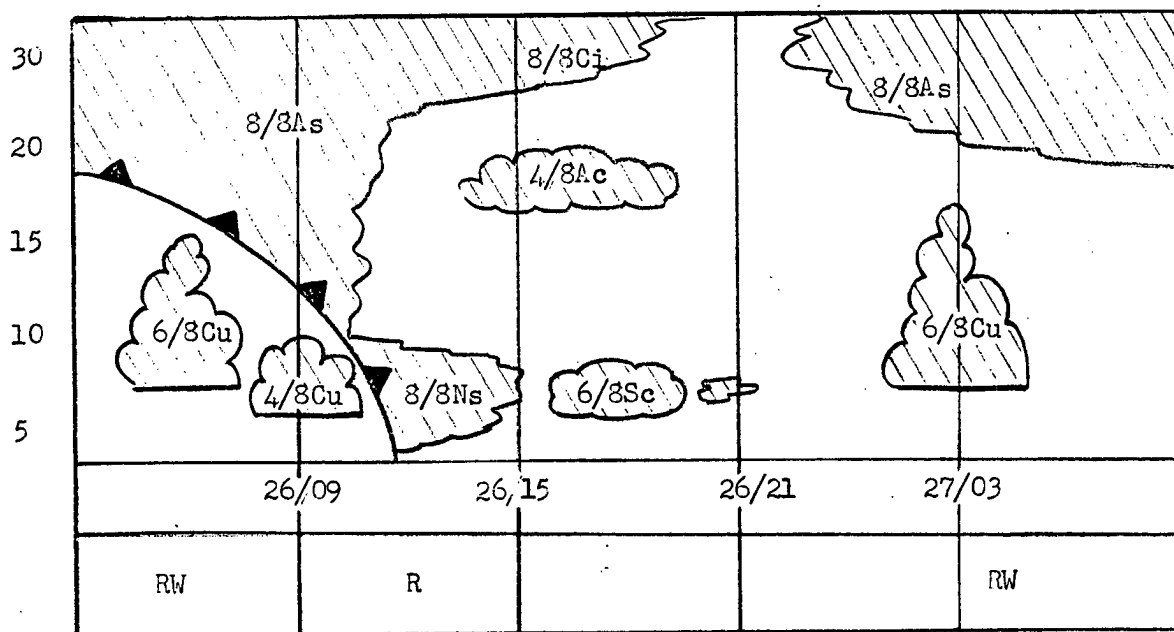
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BALLOON TRAJECTORY and WEATHER FORECAST



(Identify grid as appropriate)



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c. Terminal weather at the recovery bases and other important alternates can be presented in simple tabular form as indicated below. Two acetate covered boards are recommended so that one may always be available to the commander while revisions to the forecasts are being entered on the other. Revisions should be at intervals not greater than 6 hours, but more often if necessary.
(U)

TERMINAL FORECASTS

BASE	VALID PERIOD	Forecast Posted _____ (Date - Time)
Misawa	26/04 - 06	25 ③ 100 ⊕ 6S → 10
	26/06 - 18	25 ① 100 ③ 10 → 10+20
	(Tempo) (Inter) 09-15	25 ⊕ 3 SW → 15+25
	26/18 - 27/00	Grad Change to:
	27/00 - 28/09	100 ① 15 → 10
Kadena		

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d. "Severe" weather (restrictive to in-flight penetration by C-119 A/C) areas should be delineated on a simple areal briefing chart together with indications as to their movement and development. (U)

e. With these charts at hand, the Recovery Control Center Commander, assisted by his weather briefing officer, will be in a position to direct recovery operations insofar as weather must be taken into account. (S)

f. After the decision to recover is made and the time, place, and task unit is determined, the flight forecast should be prepared, coded in FIFOR code, and transmitted as soon as possible to the unit concerned. A copy should be retained by the weather briefing officer for monitoring purposes (met-watch) until the mission is completed. (S)

g. During active operations, a close met-watch on the weather at planned recovery points and terminals on return must be kept. In-flight reports and terminal hourly weather reports should be posted for quick reference as soon as received. It is recommended that the latter be posted on a chart adjacent to the base terminal forecast board so that differences, forecast vs actual weather, may be detected at a glance. (U)

h. In addition to the above information which should always be at hand of Recovery Control Center Commander, regular and frequent briefings on the broad-scale features of the current and forecast weather situation should be presented to the commander and others concerned with operational decisions at frequent intervals. (U)

9. Support to Weather Units at Recovery Bases.

a. Under current concepts, the Recovery Control Center will at all times have the capability to make all operational decisions affecting recovery activities and hence will require weather support as indicated above. In practice, Recovery Squadron (Unit) Commanders, particularly in the Alaskan-Aleutian area, may be authorized to make decisions as to when and where recoveries are to be made of balloons which enter designated areas in which they have responsibility. (S)

b. Weather detachments at recovery bases will thus be called upon to provide weather forecasts which will affect operational decisions to a considerably greater extent than would be the case if the operation were controlled exclusively from a single central location. To provide necessary guidance to recovery base weather detachments and insure consistency of forecasts at the Center and at

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the bases, trajectory forecasts, area wind forecasts, and PRIN charts will have to be disseminated to the Recovery Units at frequent intervals. ARFOT code is recommended for transmission of the latter two types of information. Individual flight forecasts will have to be prepared by the Recovery Unit weather detachment with assistance, as necessary and as possible, by the Recovery Control Center Weather Section. A meticulous met-watch of the recovery area, local terminal, and possible alternates during periods of active operations must be maintained by the weather detachment. (S)

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PART IV
REQUIREMENT FOR
WEATHER SUPPORT

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I. Requirement for Weather Support at Individual Recovery Bases.

A. Arrangements were made with the Commanders of the 1st Weather Wing, 7th Weather Group, and appropriate Navy Aerological units to provide (through appropriate subordinate units) the weather support required by the squadrons and detachments of the 456th Troop Carrier Wing, at their respective base locations, during the period 1 November 1955 to 1 May 1956. (U)

B. As stated to the supporting weather units, the nature of the operation was essentially as follows: Unit aircraft would be dispatched singly, or in small flights to make rendezvous with other airborne vehicles within 1100 nautical mile radius of the base. In most cases, the time and place of rendezvous would be prescribed by a Control Center at Shiroy, Japan, and a flight forecast for the mission would be furnished with the directive message ordering its execution. In other cases, the track and speed of the vehicles would be furnished to the squadron or detachment and the optimum point in time and space for rendezvous determined locally. (S)

1. Under the first concept of operations, required weather support was as follows:

a. Receive and if necessary decode flight forecasts received from Shiroy Control Center Weather Section, check them for accuracy against the latest weather information available locally, and resolve any major differences with the weather section at Shiroy. Project organic communications facilities were to be used for this purpose. (U)

b. Prepare necessary briefing aids and flight cross-sections, brief crews and operational personnel. (U)

c. After the mission was airborne, maintain an intensive met-watch of the weather along the route, at rendezvous point, at the home base and possible alternates. Bring any operationally significant changes to the attention of the Unit Operations Officer immediately so that the mission could be cancelled or altered to advantage, as appropriate. (U)

2. Under the second concept of operations, required weather support was as follows:

a. The Unit Operations Officer advised the base weather unit of the latest observed and forecast positions of the vehicle (s) which was (were) to be intercepted. (U)

b. The weather unit would prepare a forecast of the weather which the vehicle would encounter as it moved along its

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forecast path. It would present this, preferably in flight cross-section form, to the Unit Operations Officer, who made the decision where and when to effect rendezvous. Essentially VFR conditions between 10,000 feet and 20,000 feet were required at rendezvous point. (U)

c. The weather unit would then prepare the mission flight forecast, briefing aids, etc., and carry on as in 1b and c, above. Flight altitudes were expected to be near 10,000 feet most of the route. Winds to 20,000 feet were required at the rendezvous point. (U)

C. Under both concepts, it was necessary at all times for the Unit operations personnel to have a thorough understanding of the large-scale current and forecast weather situation and of the local current and forecast weather at important terminals in the vicinity. This required frequent routine briefings and the transmittal of selected current weather reports and terminal forecasts from the weather station to the Unit Operations Officer. Special telephone circuits were provided for this purpose. (U)

D. At such times as the second concept of operation was in effect, certain information could be furnished from the Shirazi weather section if requested via project organic communications facilities for guidance in preparing flight forecasts and to insure consistency in forecasts issued from the two locations. This information could include: (U)

1. Coded forecasts for 12, 24, and 36 hours from the latest charts. (U)

2. Block or zone wind forecasts at appropriate levels for 12, 24, and 36 hours. (U)

Judicious interpolation in time and space using this information and augmented by such information as was available locally, permitted the preparation of accurate operational forecasts. When time permitted, additional assistance in the preparation of specific forecasts might also have been secured from the Shirazi weather section. (U)

E. The exacting requirements for weather support in these operations necessitated the designation by the Commanders, 1st Weather Wing and 7th Weather Group, of one weather officer at each base as Weather Liaison Officer to the appropriate unit. This action was not intended to place the entire burden of operational weather support upon this one officer nor to deny this officer's service to the Weather Detachment for other duties at such times as his services were not required by the unit. It was intended that he be the primary contact between the unit and the Weather

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Detachment, work out the detailed arrangements for the provision of weather support, and supervise the provision of this support.(U)

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PART V

WEATHER SUPPORT FOR
BALLOON LAUNCHING OPERATION

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I. Weather Support for Balloon Launching Operations.

A. As stated to the subordinate weather units of the 2d Weather Wing charged with support to the launching detachments, the nature of the operation was as follows: (U)

1. Personnel of the 1110th Air Support Group would be launching high-altitude meteorological balloons from the particular site during the period of 1 December 1955 to 1 May 1956. These balloons would carry intricate meteorological equipment and recording instruments. The data to be secured as a result of these flights would be forwarded to Headquarters USAF for reduction, interpretation, and compilation. Personnel of the launching detachments were concerned exclusively with the launching operation and were not familiar with meteorological instrumentation or the nature of the data which would be obtained. (U)

2. Radiosonde instruments were to be attached to selected balloons and monitored by ground equipment to provide information on the rate of rise of balloons and of level-off altitudes. The proximity of this radiosonde to the gondola results in radiative effects causing incorrect temperature readings which might be in excess of ambient air temperature in the amount of 3-8°C. Radiosonde data was therefore probably of limited use for most meteorological purposes but the height error introduced by these temperature inaccuracies was tolerable for telemetering purposes. However, these data were offered to the weather detachments for such purposes as they might see fit. (U)

B. Weather support to be provided by the Base Weather Detachment included observations and forecasts of the following elements which were considered restrictive to balloon launching operations: (U)

1. Surface winds over 13 knots in strength or with significant gustiness. (U)

2. Precipitation in excess of very light drizzle or very light snow showers. (U)

3. Significant icing at the surface (fog with temperature below 0°C) or aloft (clouds of extensive vertical development at temperatures 0°C to -39°C). The presence of an intense temperature inversion might complicate but not necessarily preclude launchings. (U)

C. Advance knowledge of whether suitable or unsuitable weather would obtain was necessary for the following reasons: (U)

1. Certain elements of the instrument and power components of the gondola required final-type processing several hours prior to launch. If, however, launching could not be accomplished within 12

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hours therefrom, the element had to be discarded and the process repeated. (U)

2. Maintaining the directed volume of launchings required careful programming of hydrogen generation operations. Extraordinary efforts to generate the maximum amount of hydrogen were planned for all anticipated bad-weather periods. (U)

3. Preventive maintenance on equipment and minor repairs to it must be accomplished, whenever possible, at times when these activities would not curtail launching operations. Effective planning for such work was contingent upon accurate forecasts. (U)

4. Directed training and other military duties were to be accomplished during "non-operational" periods. Again, accurate forecasts permitted these requirements to be met without interference with the primary mission. (U)

D. Accordingly, it was requested that the appropriate weather unit furnish the launch organizations, upon request, with current information and forecasts of the weather elements listed in paragraph B, above, for periods up to 36 hours. (U)

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PART VI

COMPARISON OF CLIMATOLOGICALLY-PREDICTED
"HINDCAST" AND ACTUAL BALLOON TRAJECTORIES

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I. COMPARISON OF CLIMATOLOGICALLY - PREDICTED, "HINDCAST", AND ACTUAL BALLOON TRAJECTORIES.

A. This part presents a comparison of the typical complex of trajectories which was expected from each launch site with that which would (theoretically) have been realized had one successful launch of a 7 day endurance balloon been made at each launch site each day of the period 10 January - 6 February 1956. Since "hindcasts" were used to represent theoretical trajectories, a comparison is made of actual vehicle trajectories (as revealed by Aeronautical Chart and Information Center plots) with hindcasts computed for the period in question to provide a qualitative index of their accuracy. Inclosures 1 through 22, this part, pictorially present this comparison. (S)

B. Inclosures 1 through 4 show the trajectory complex expected from each site. These trajectories were computed by Directorate of Climatology, Headquarters Air Weather Service from analyzed 200 mb charts (adjusted gradient-wise for the lighter wind speeds at 100 mb) of December and February, 1949, 1950 and 1951. (S)

C. Inclosures 5 through 8 shows the "hindcast" trajectory complex from each site for each day of the operational period. (S)

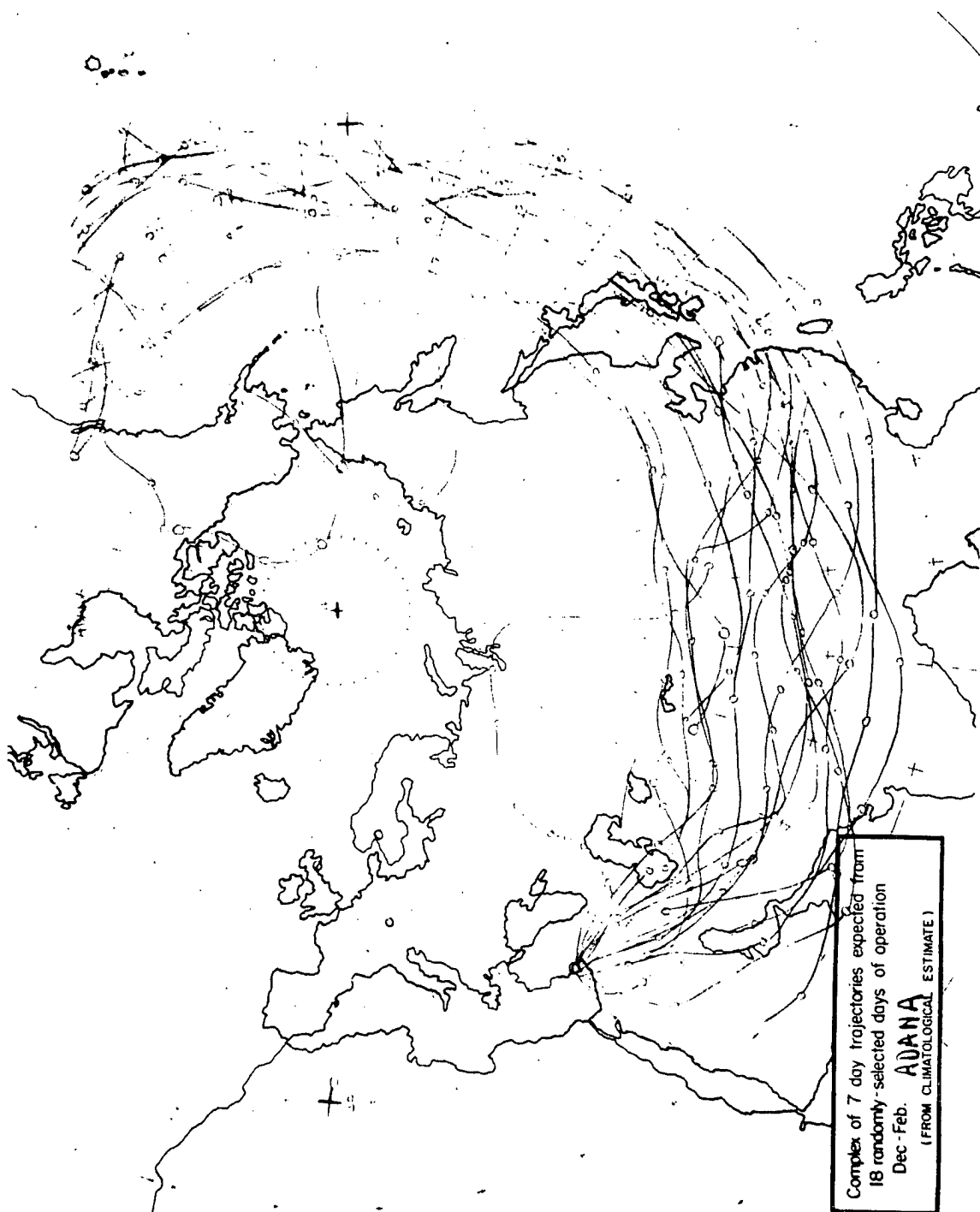
D. Inclosures 9 through 22 show, for certain vehicles which were recovered, the trajectory actually taken by each vehicle from launch to recovery, (dotted line), together with the "hindcast" trajectory valid for that launch day, (full line). Hindcast and actual travel times are plotted at end points. The sample is too small to support an intensive analysis but the following general tendencies are apparent: (S)

1. The hindcast and actual trajectories from Detachment 2 are in good agreement. The hindcast indicates balloon emergence from the continent, on the average, about 12 hours after this event actually takes place. Wind speeds were being estimated about 25 per cent slower than they actually were. (S)

2. The hindcasts and actual trajectories from Detachments 1 and 5 are in fair agreement. The hindcasts indicate balloon emergence from the continent from 3/4 to 2 days before the event takes place. Wind speeds were being estimated about 25 per cent faster than they actually were. (S)

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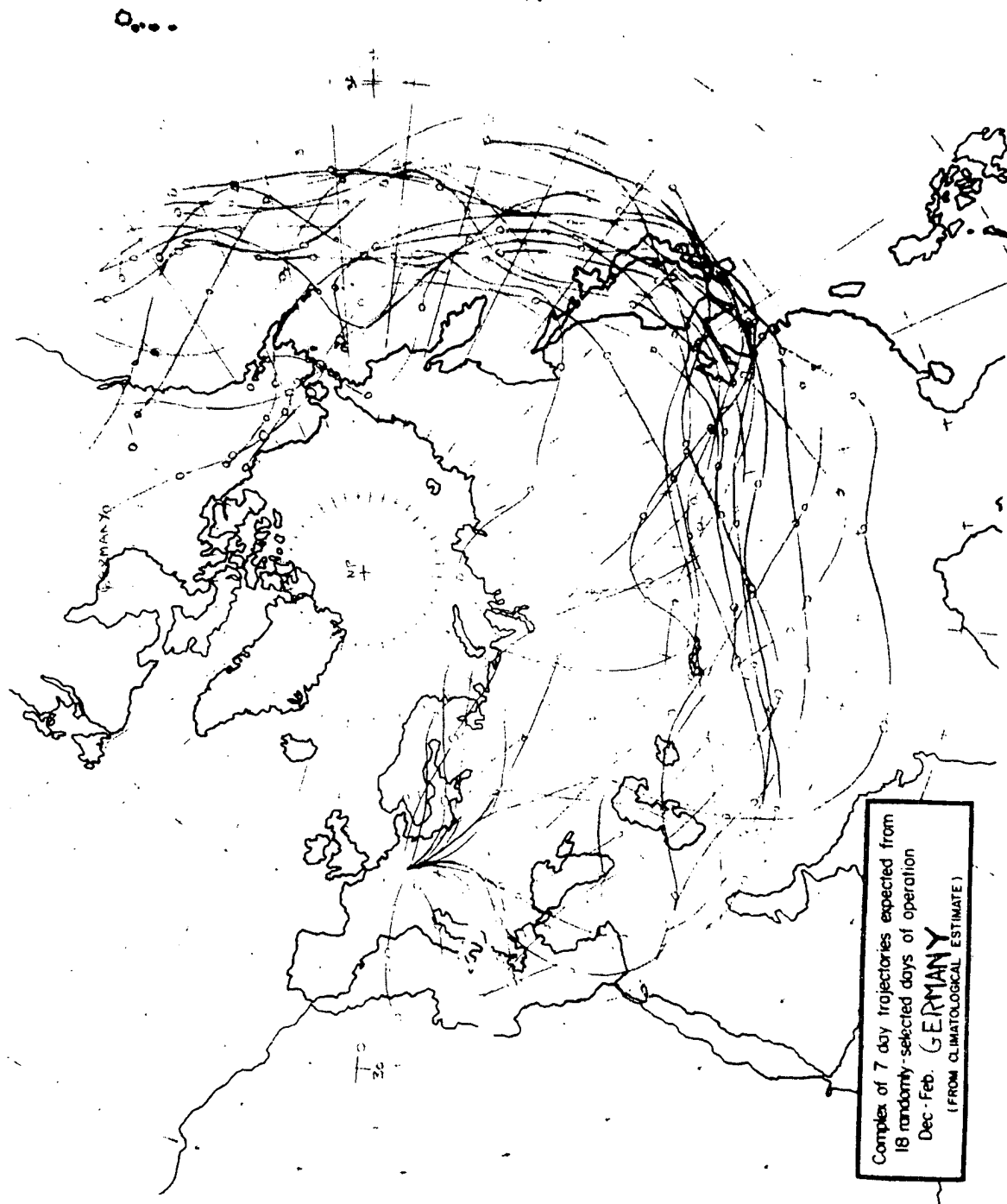
Incl 1

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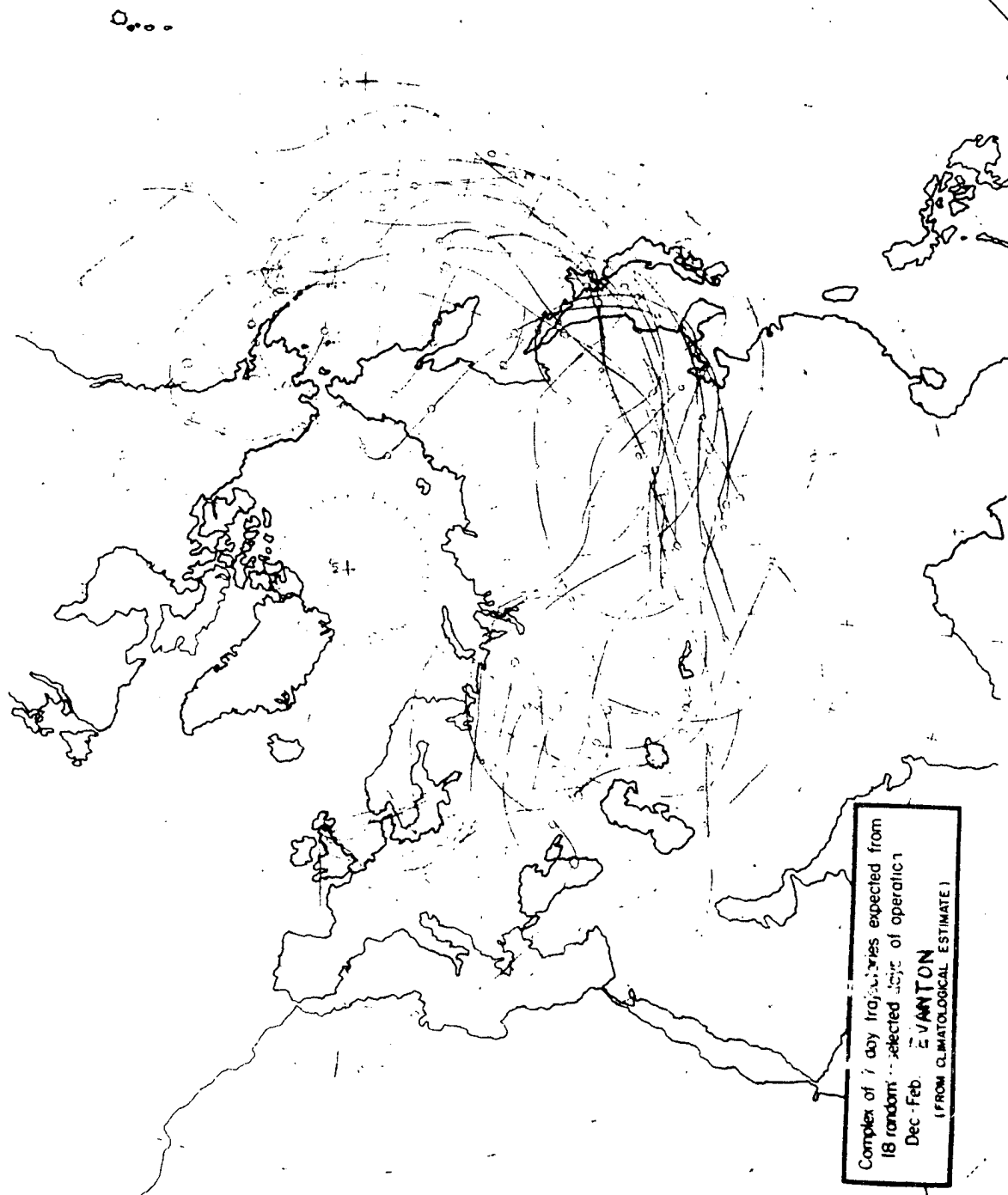
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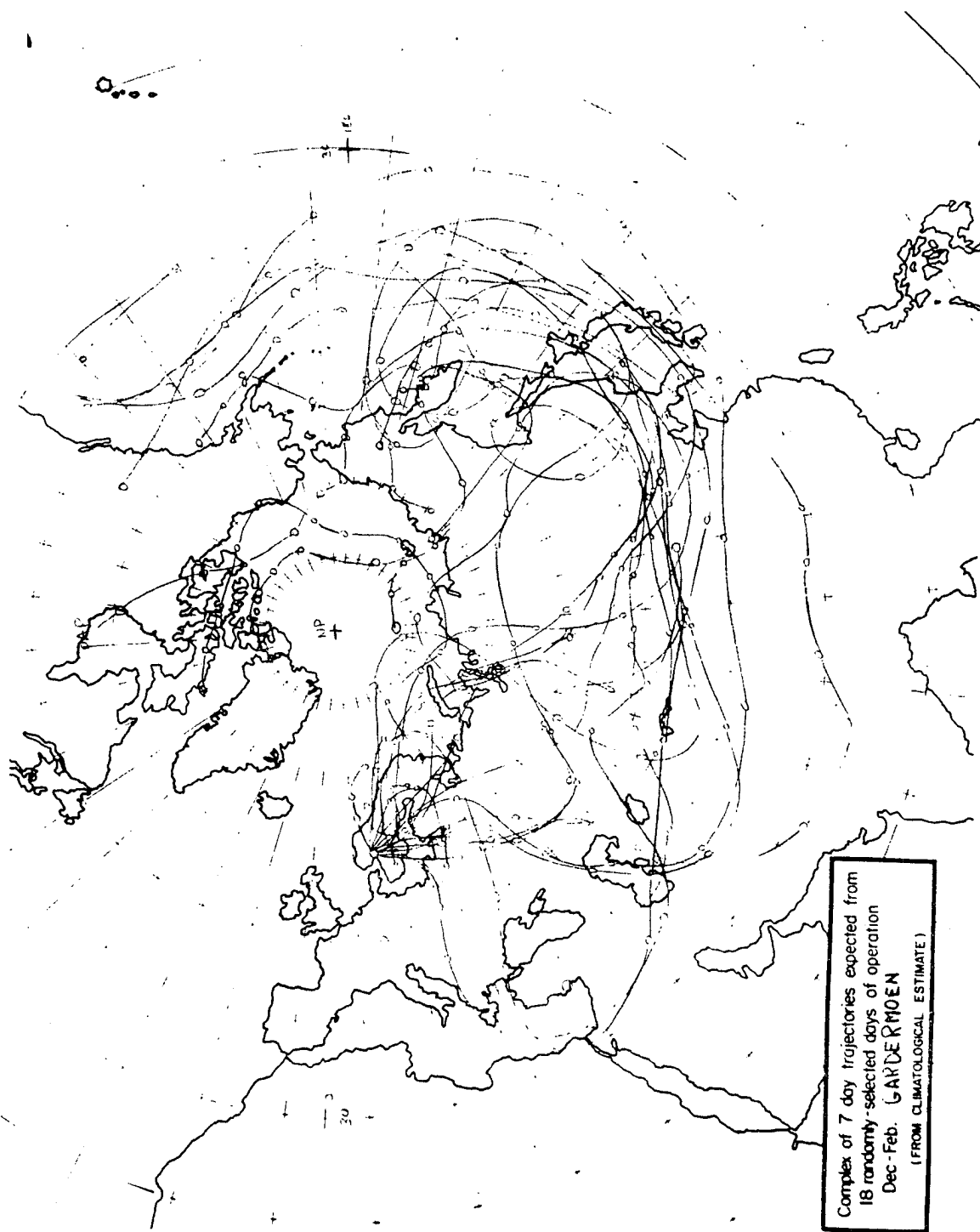
Incl 3

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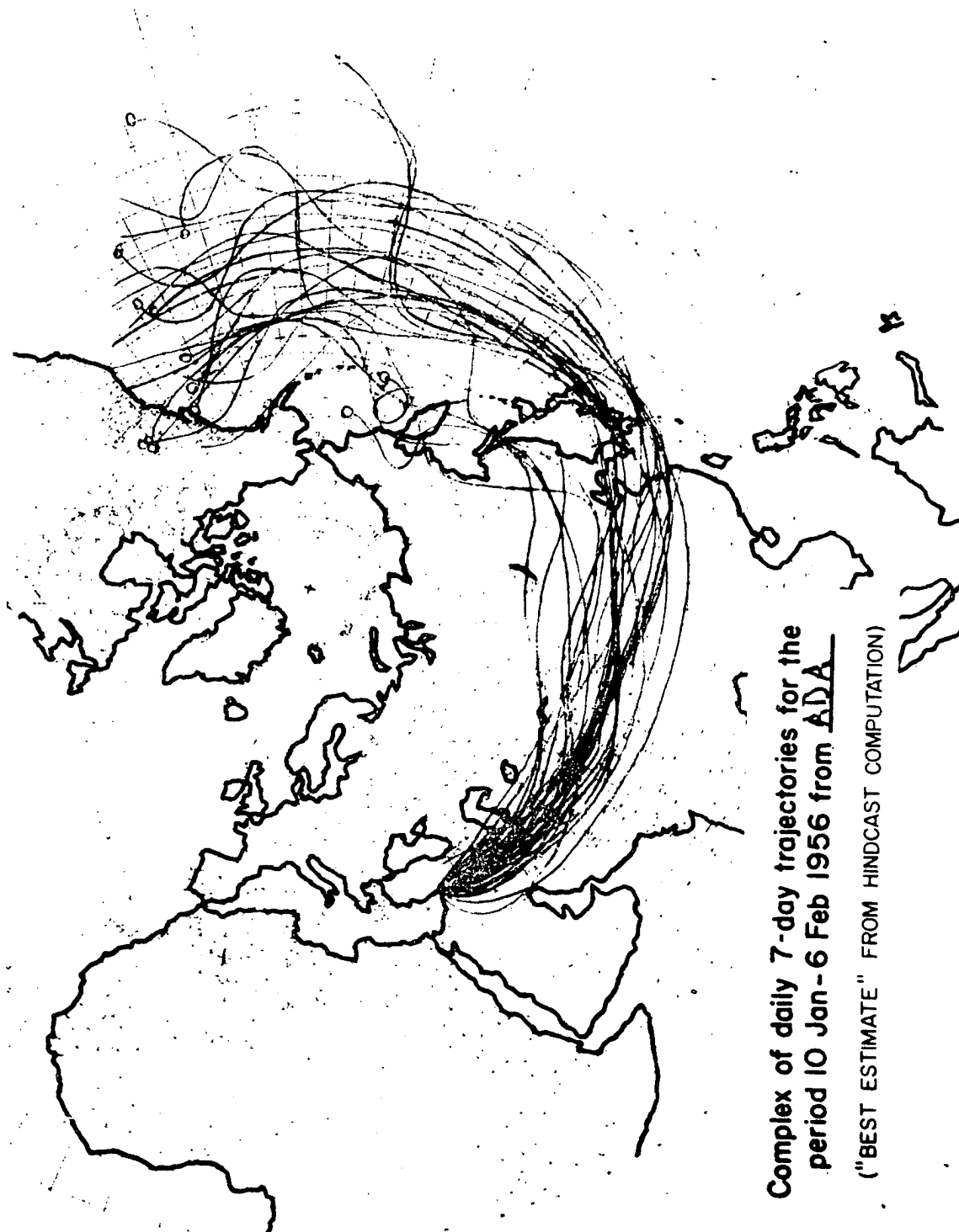
Incl 4

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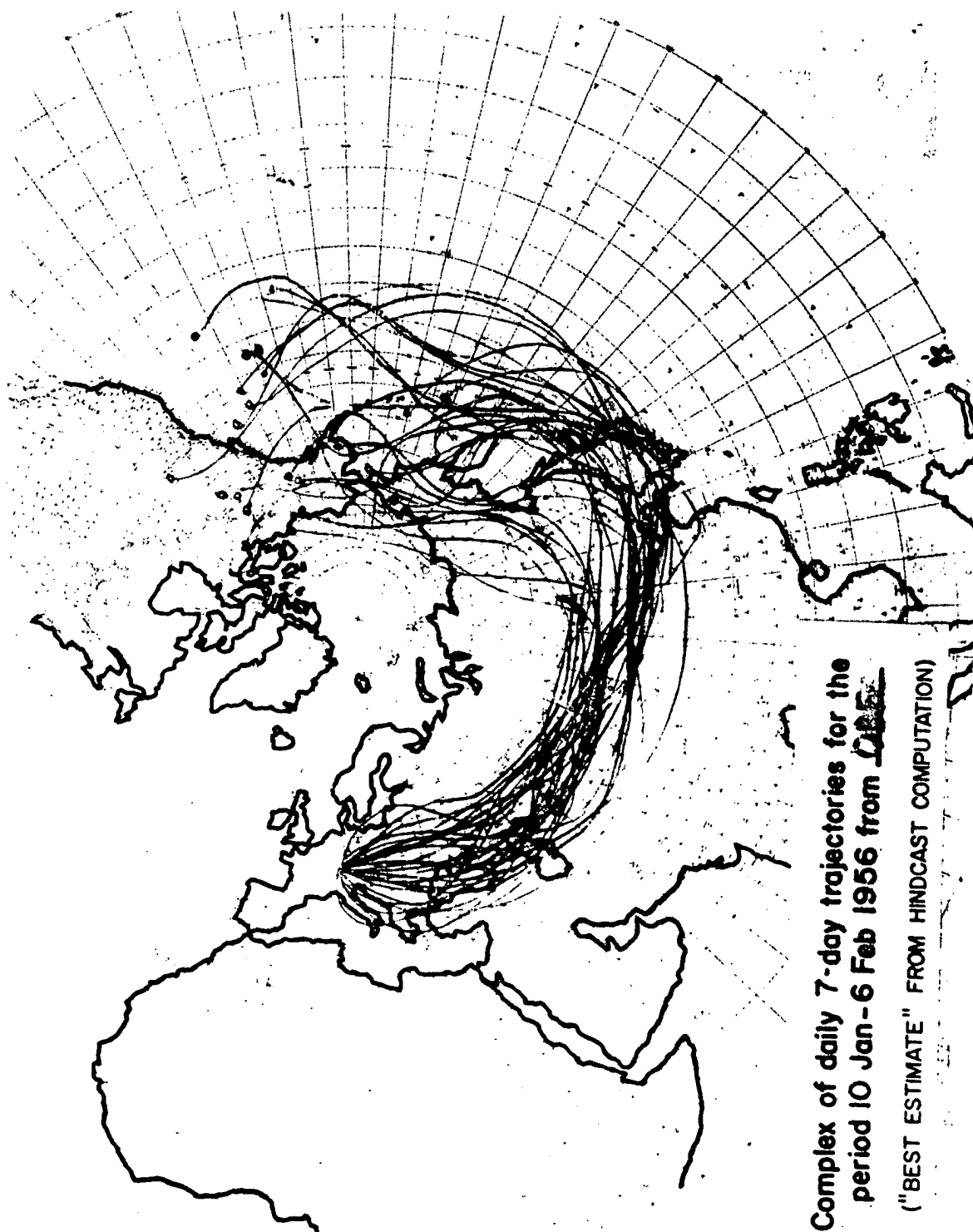
Incl 5

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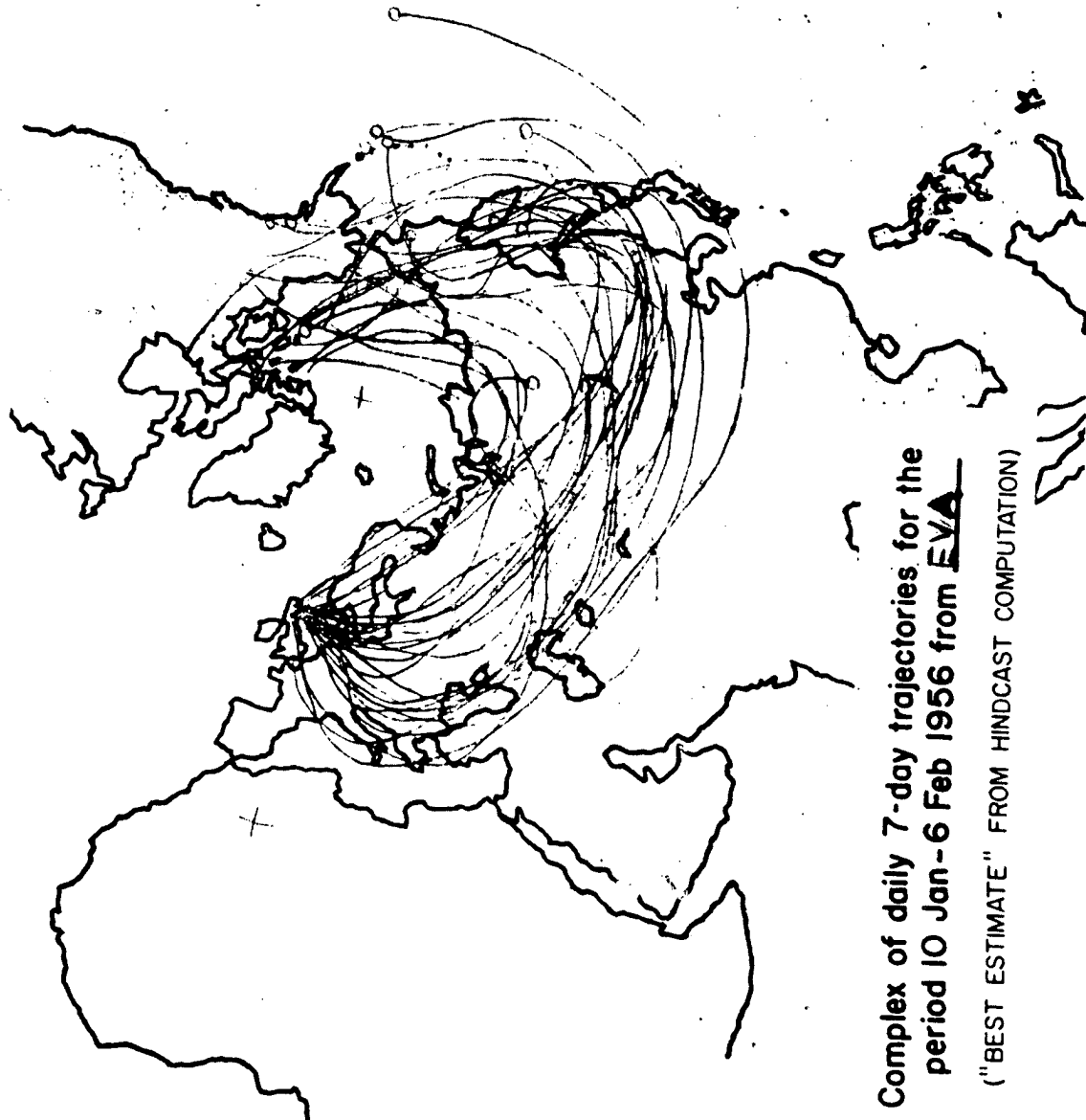
Incl 6

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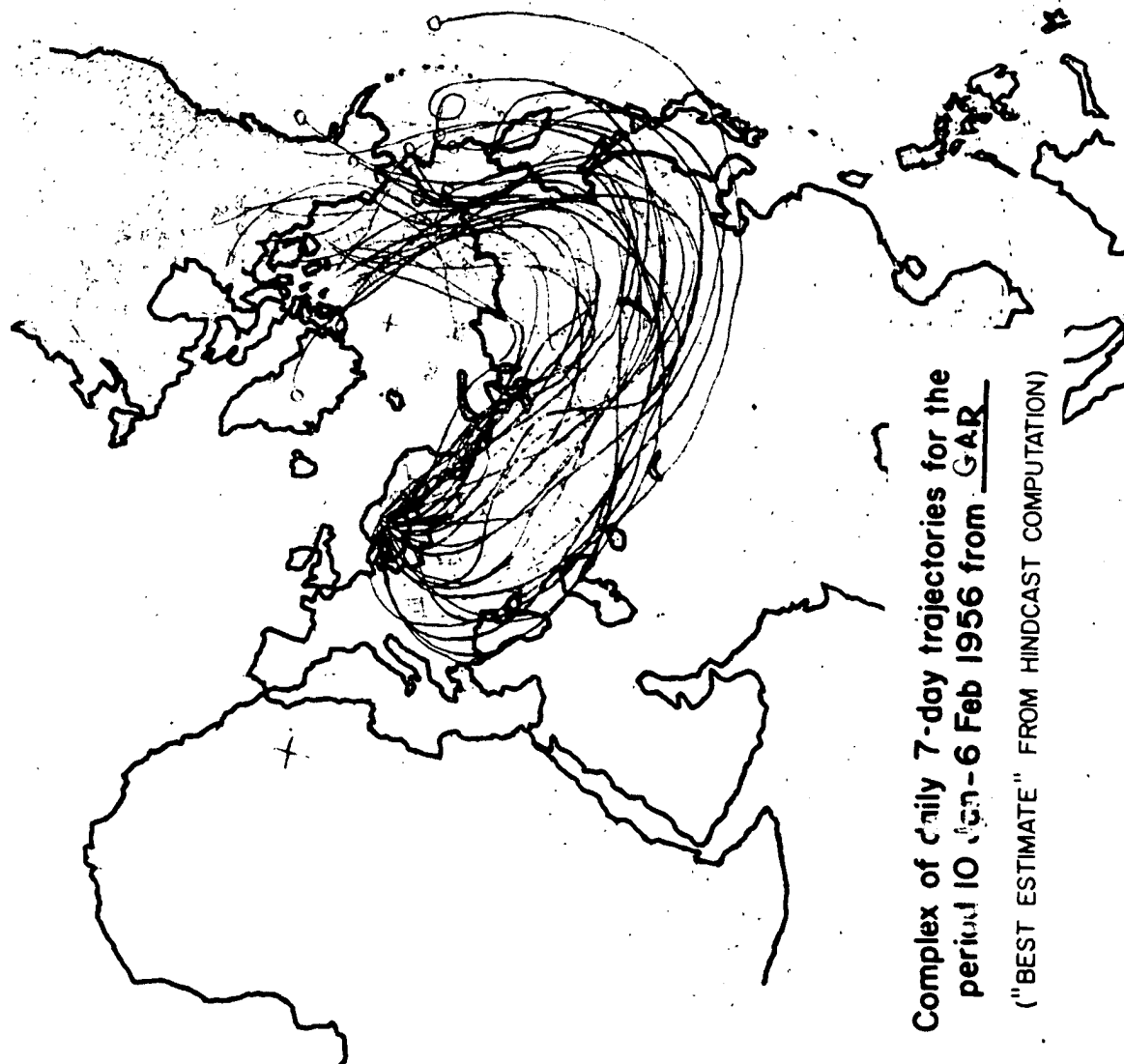
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Complex of daily 7-day trajectories for the
period 10 Jan - 6 Feb 1956 from GAR
("BEST ESTIMATE" FROM HINDCAST COMPUTATION)

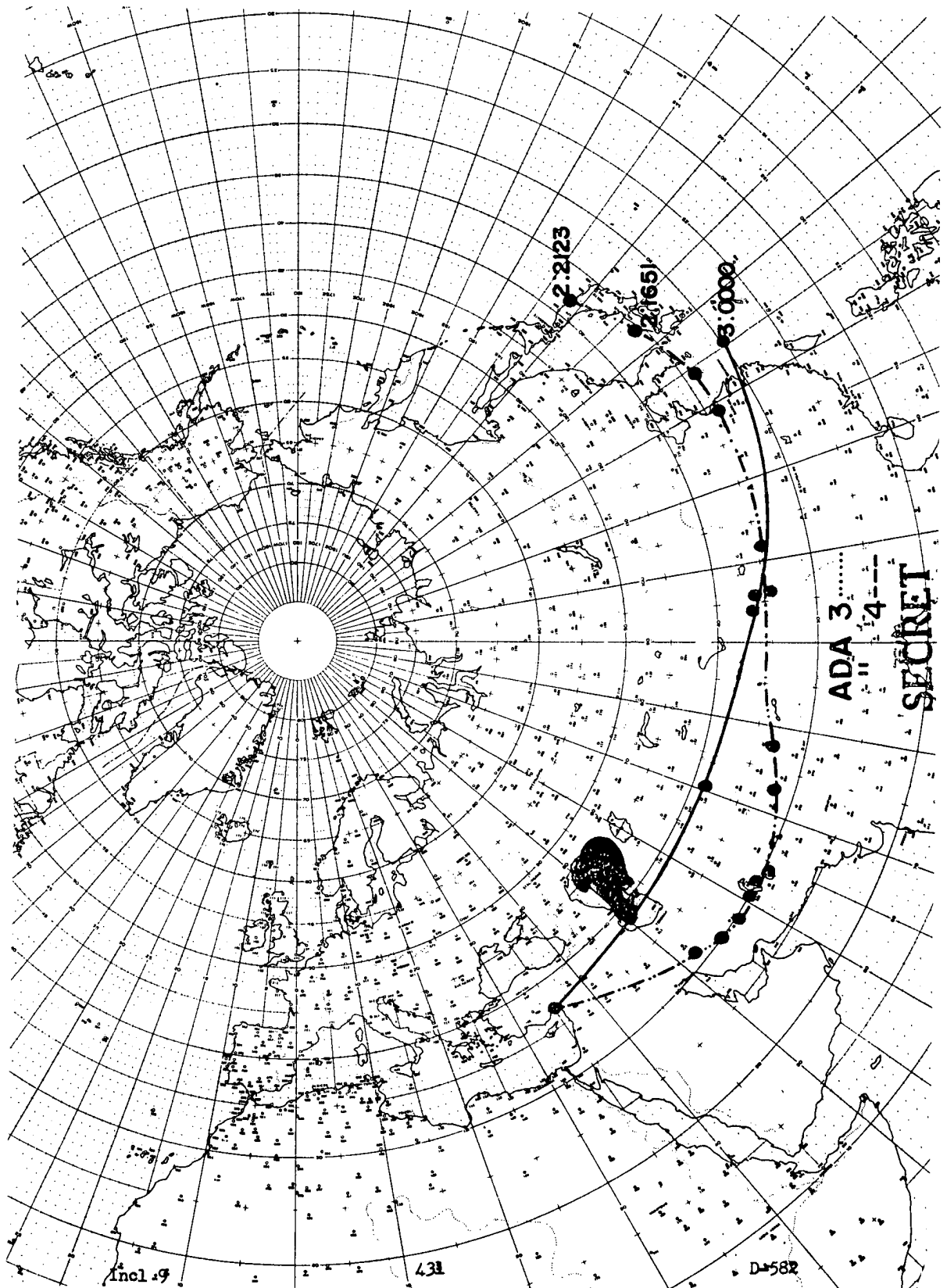
Incl 8

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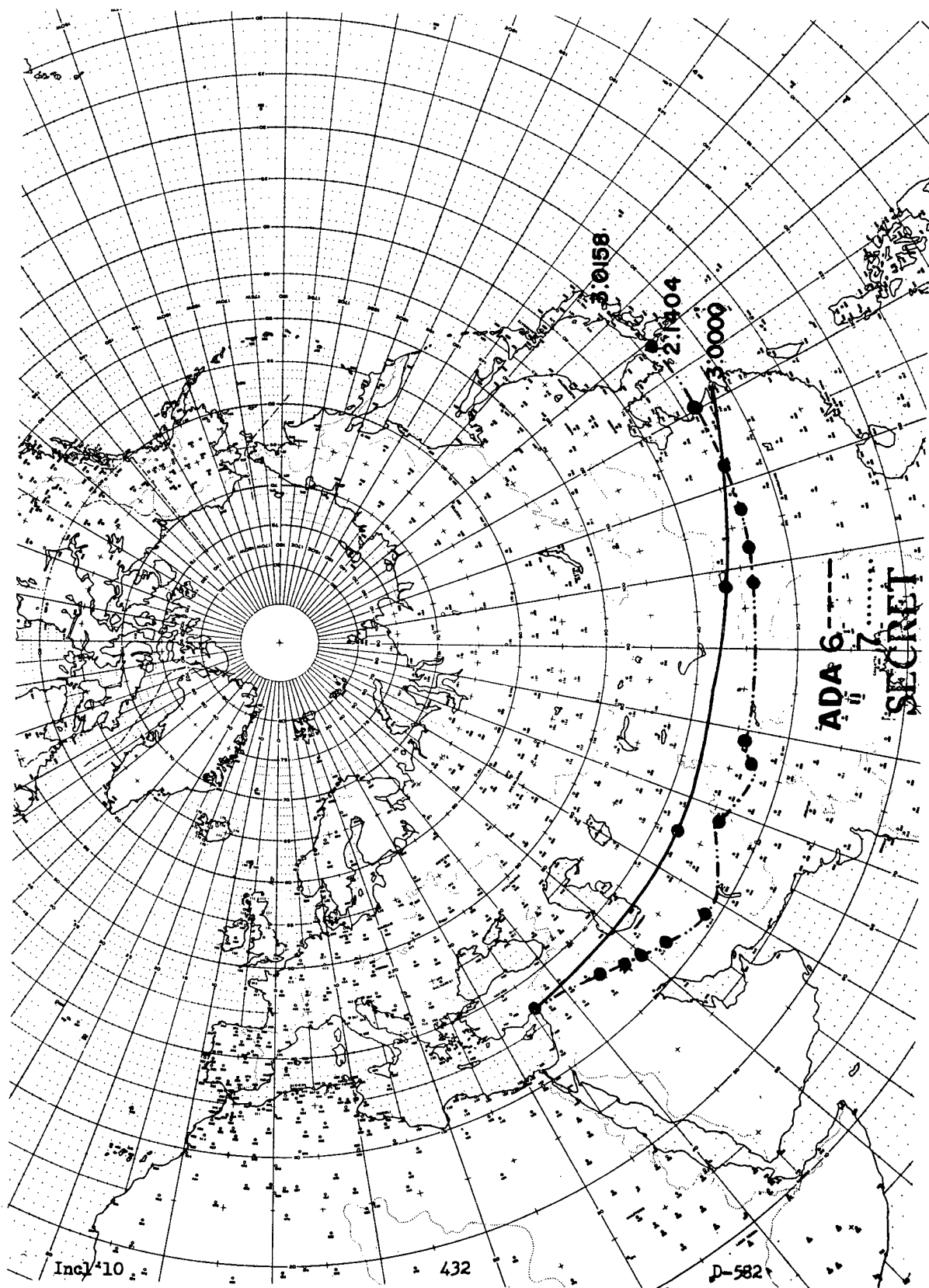
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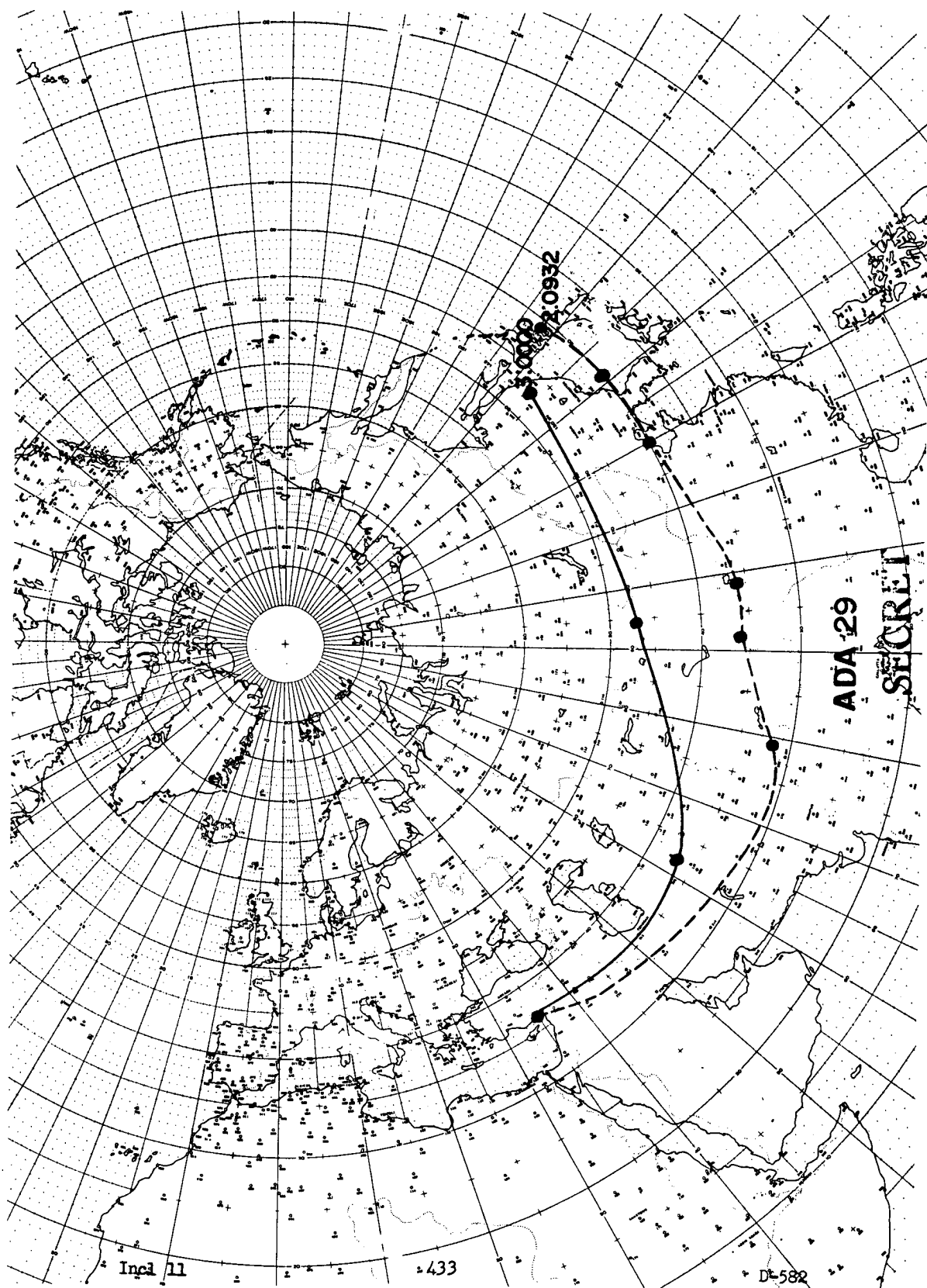
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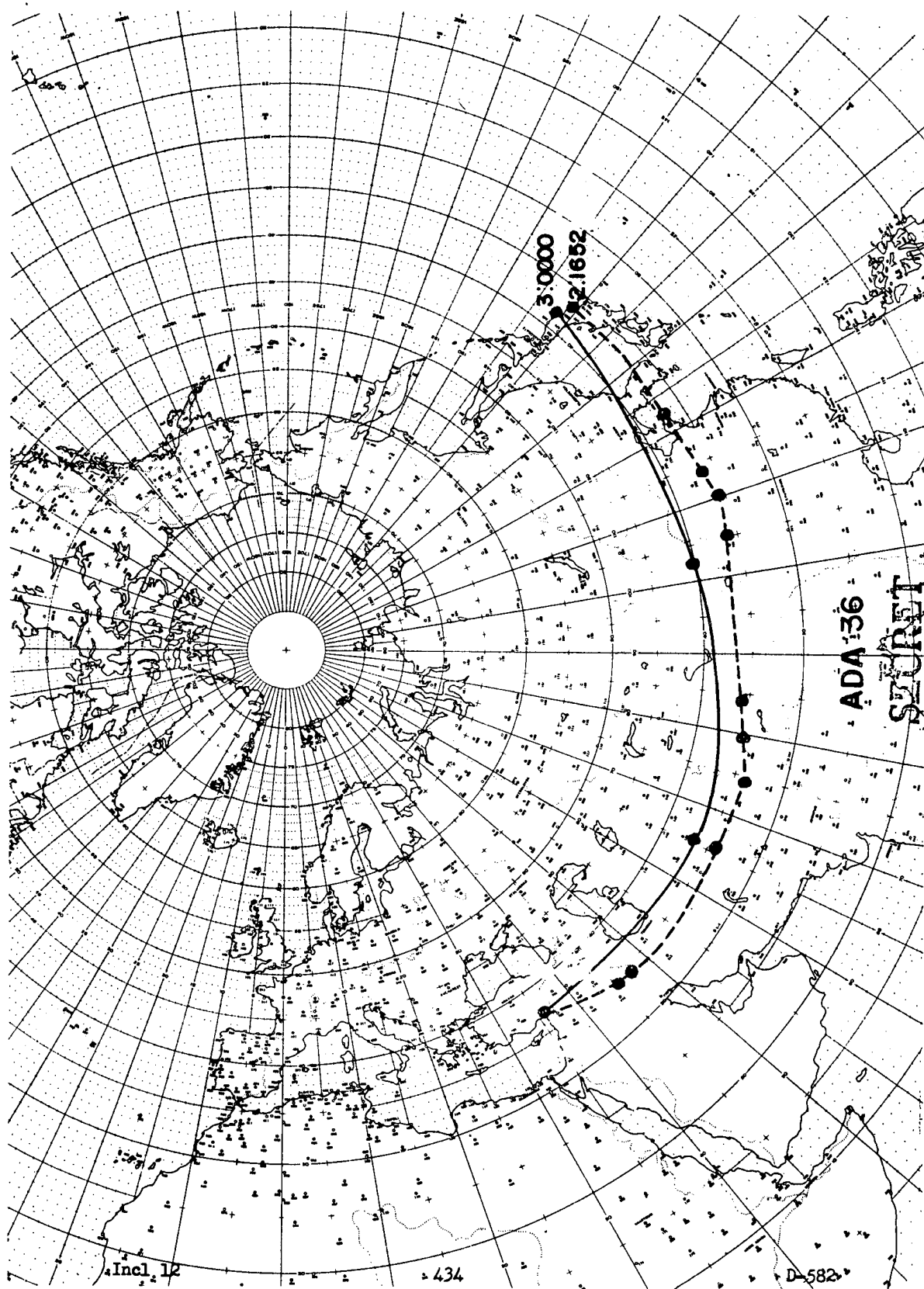
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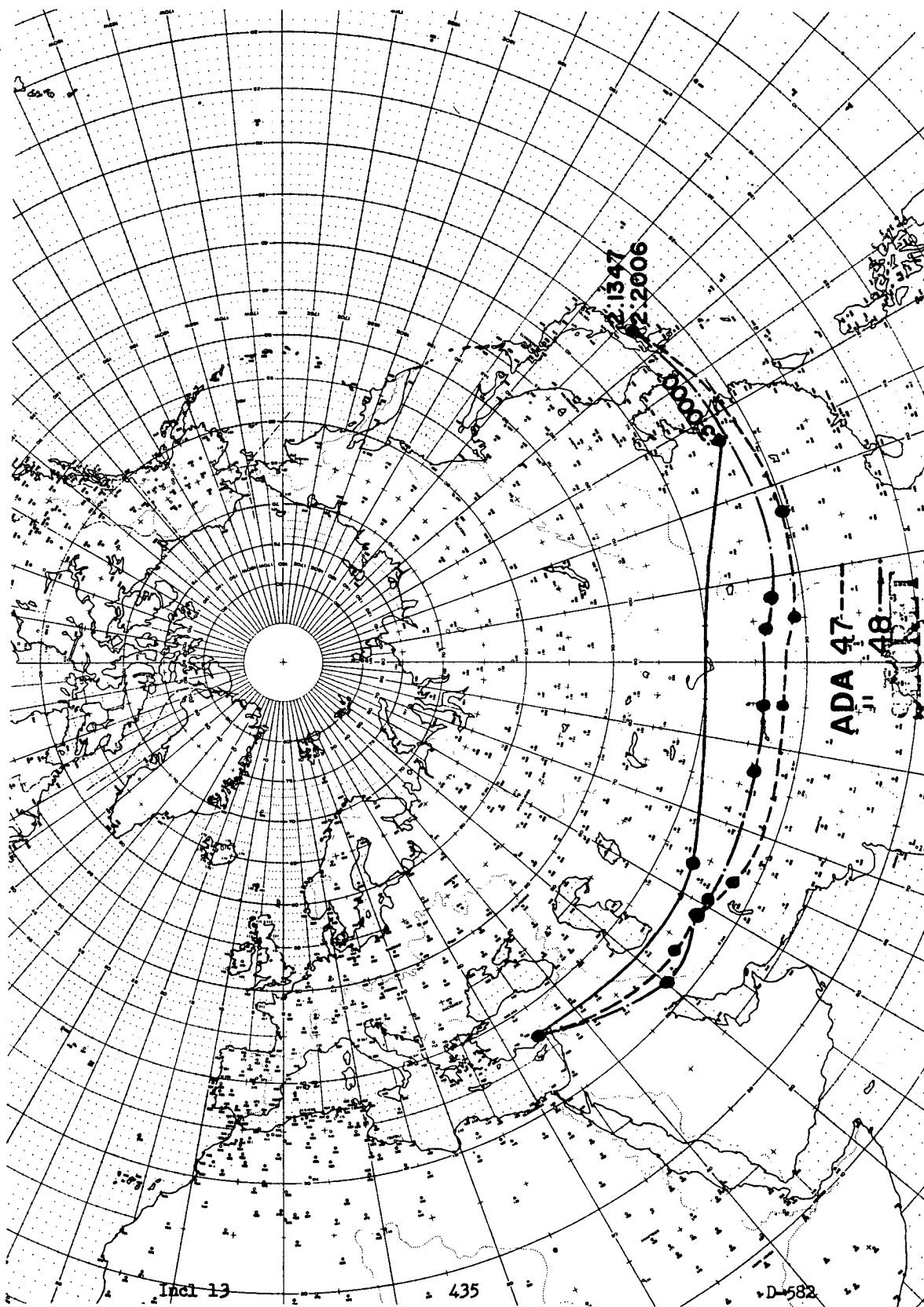
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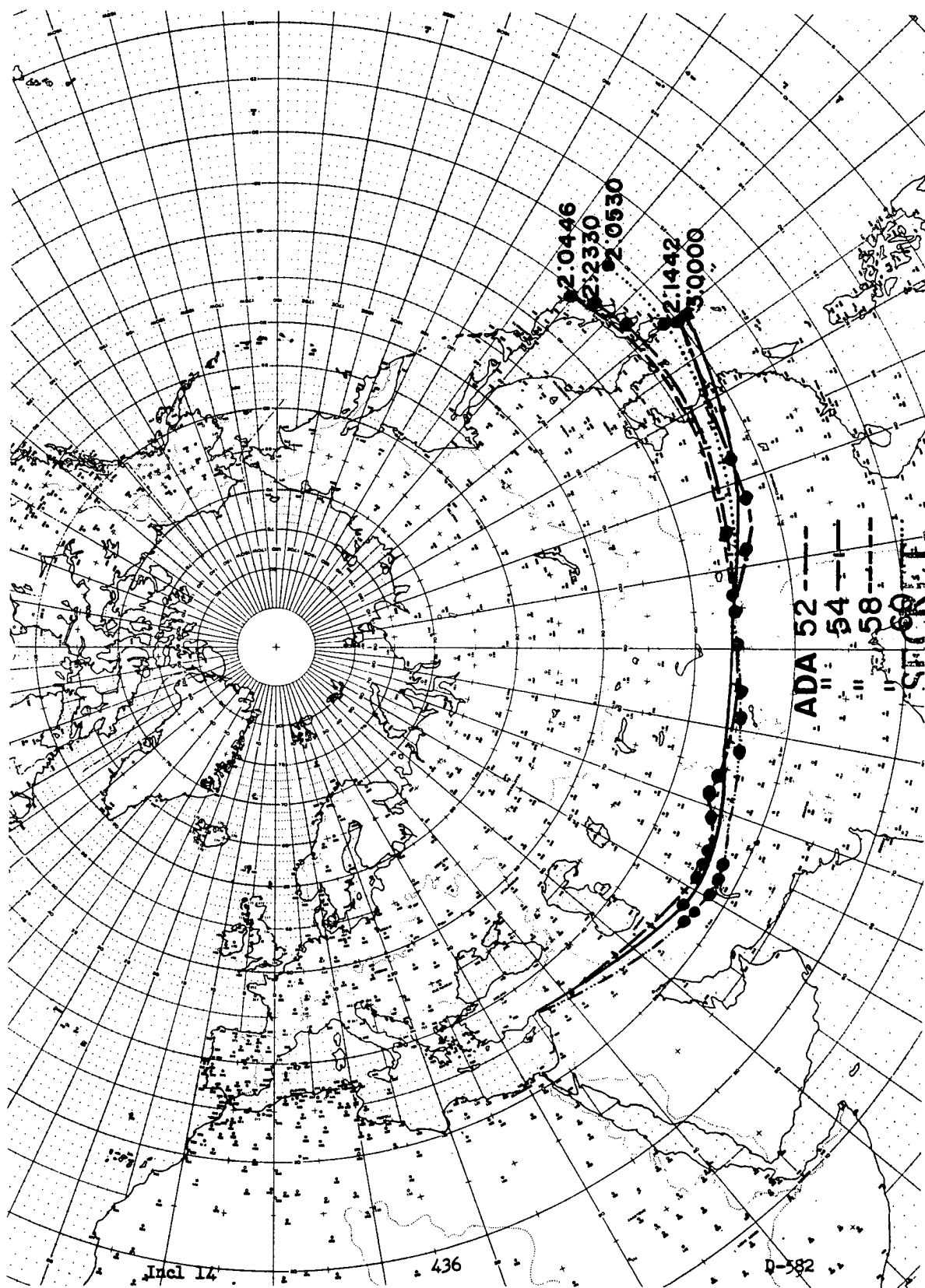
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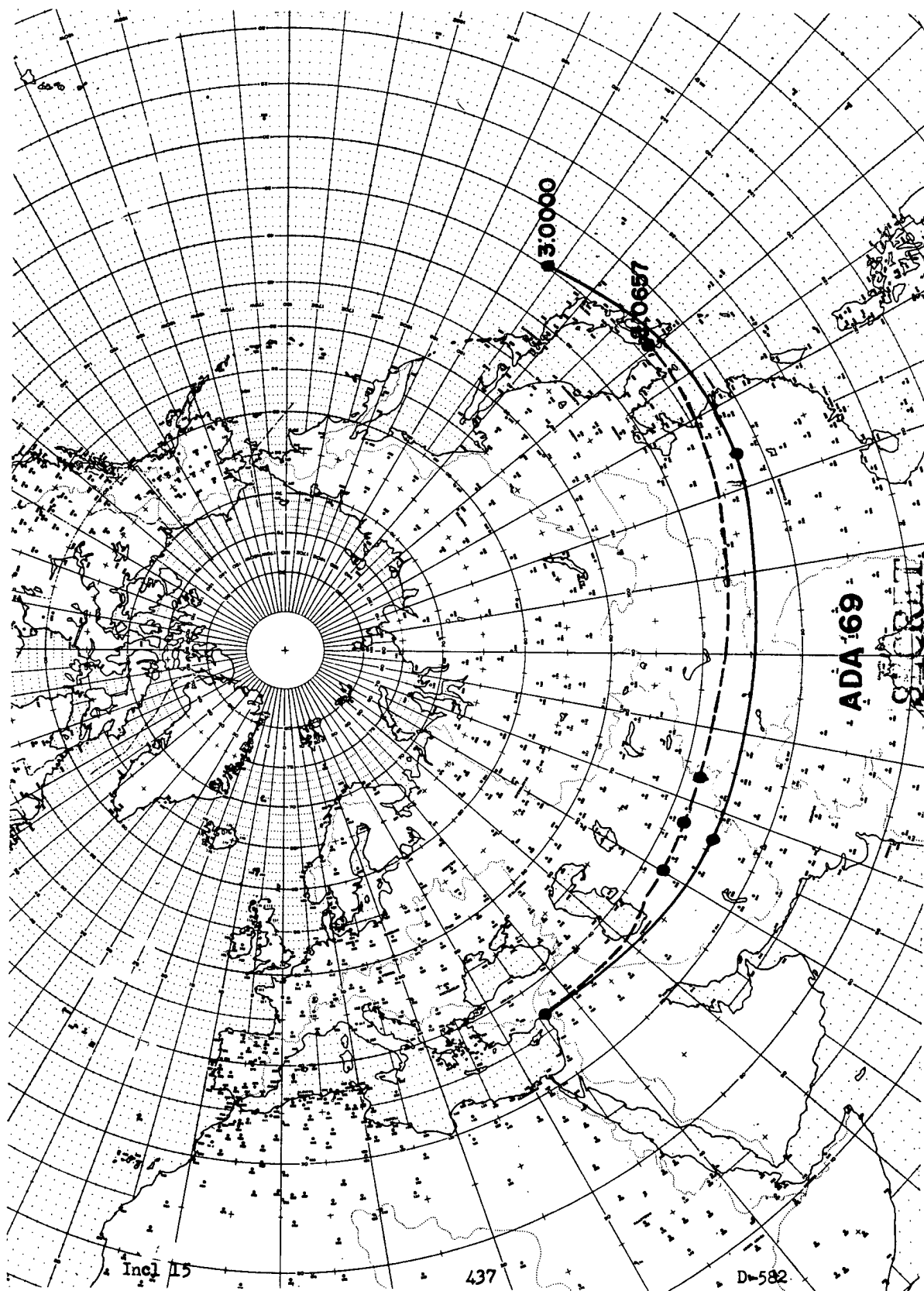
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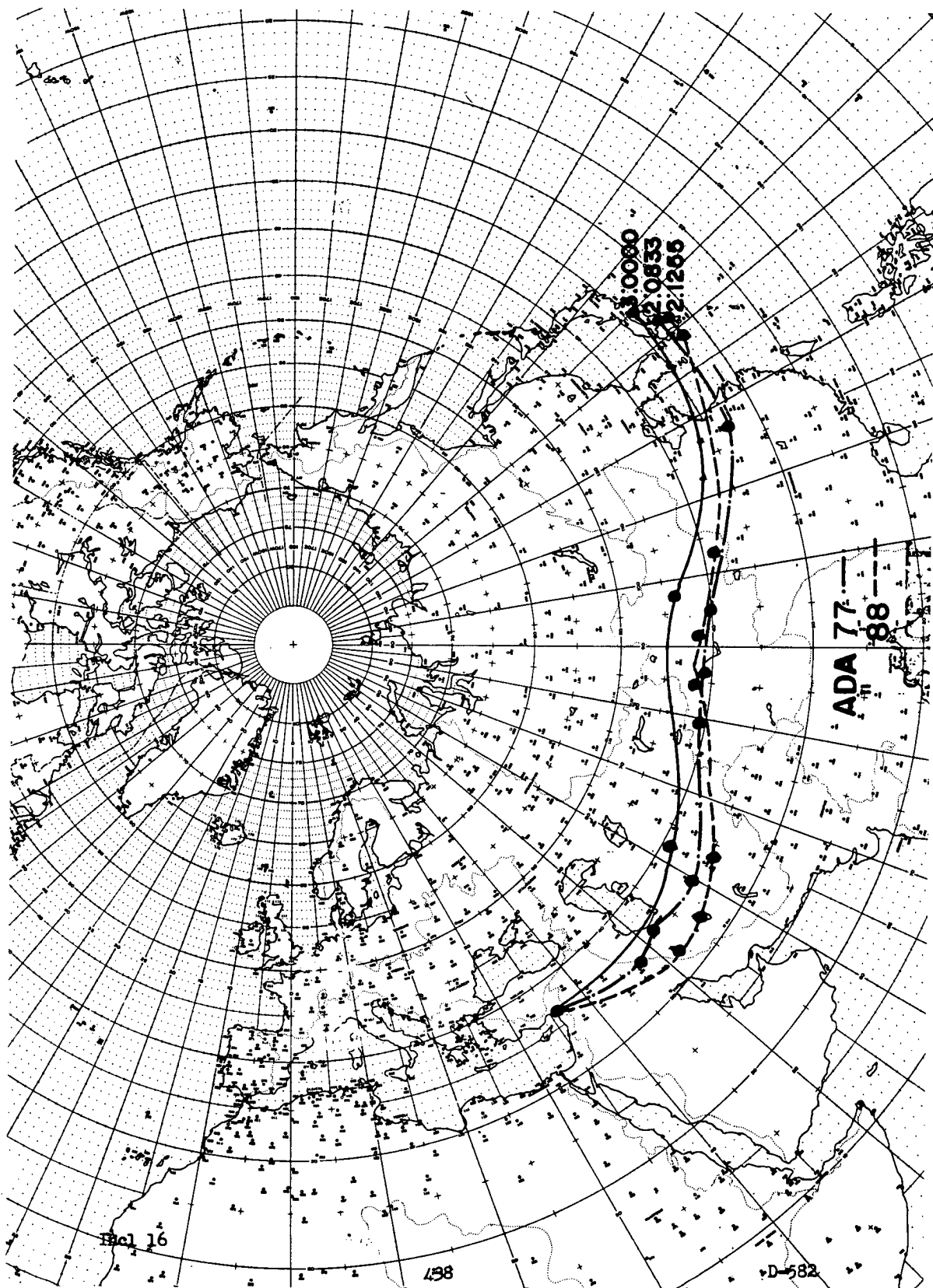
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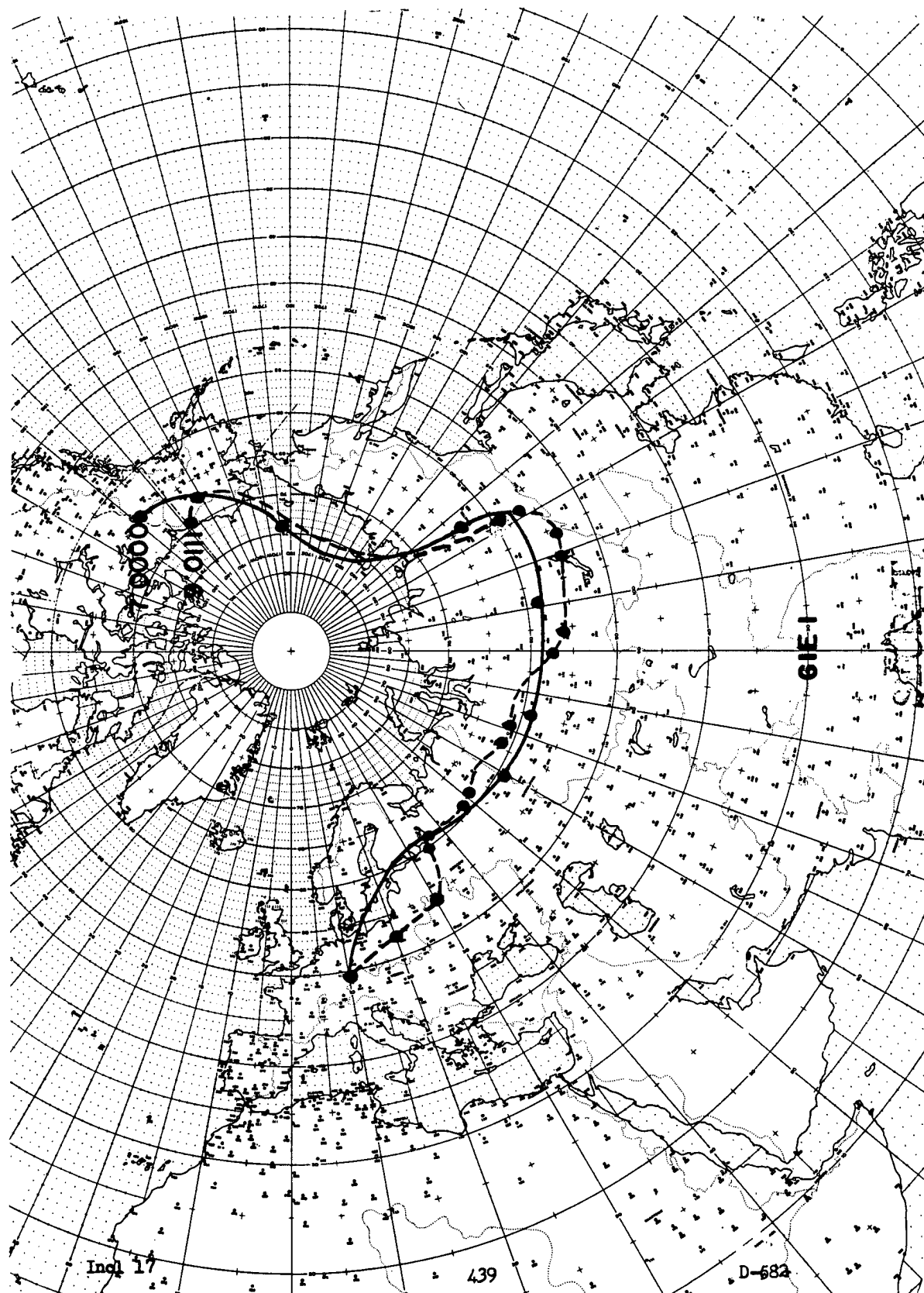
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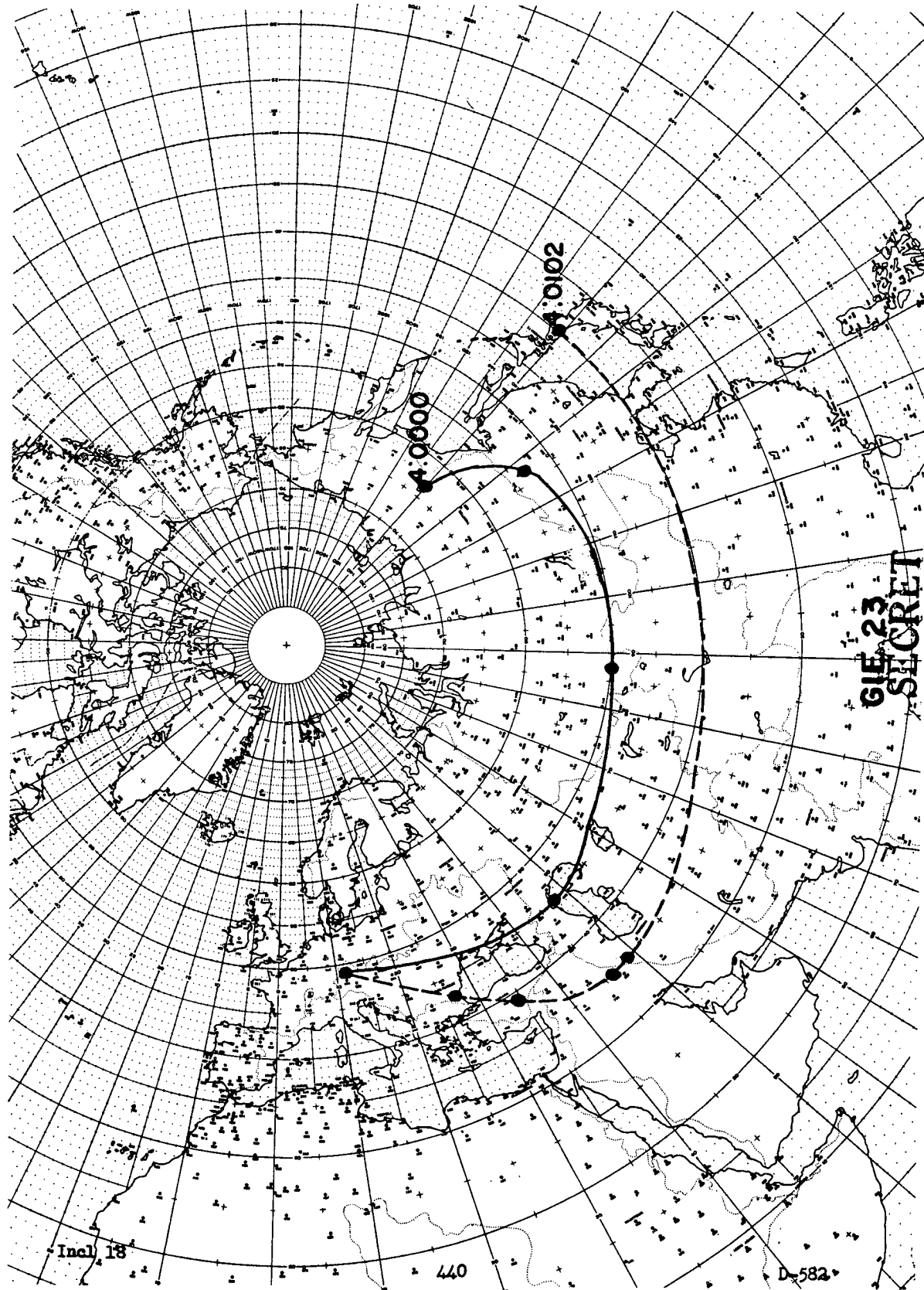
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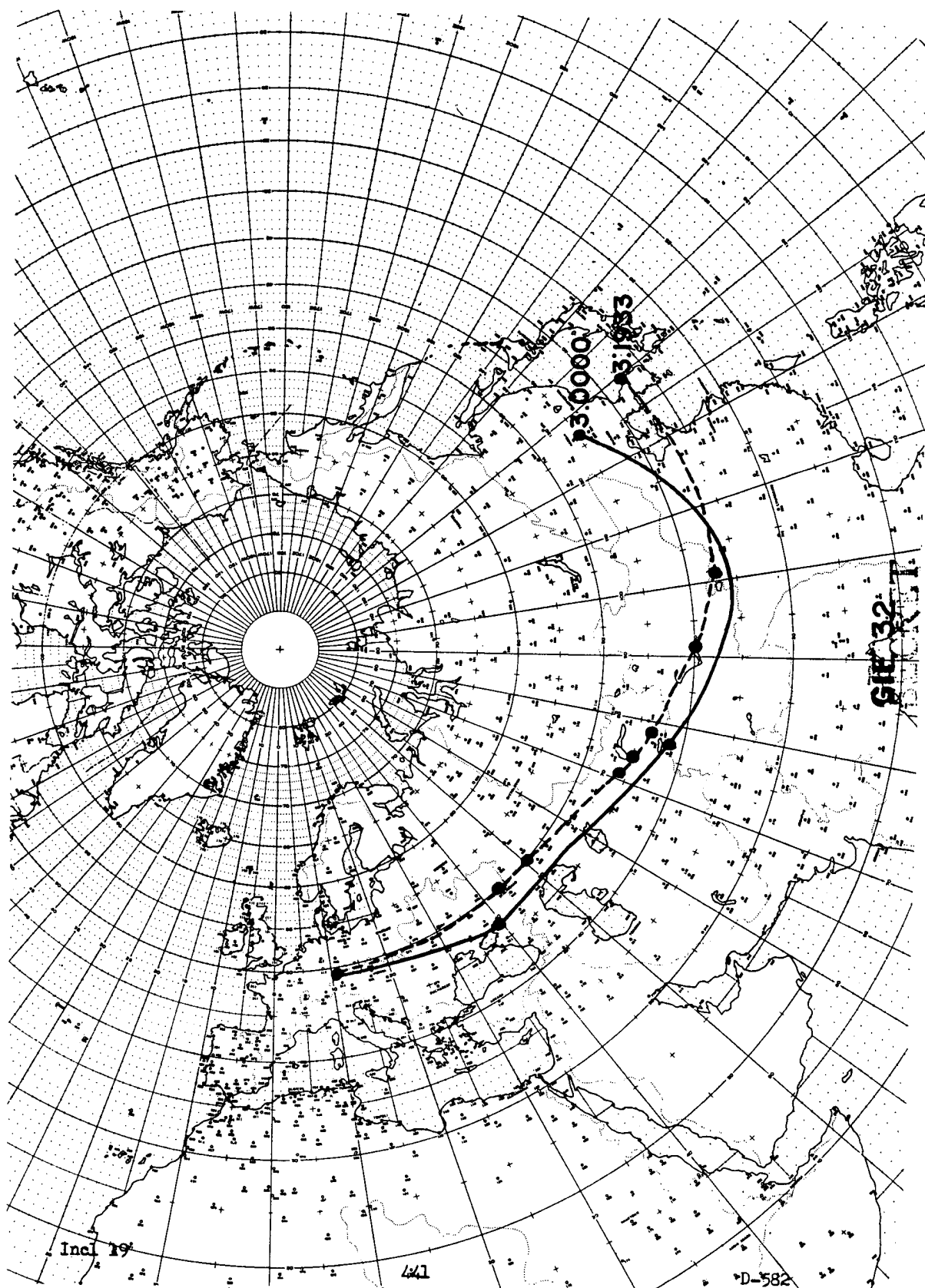
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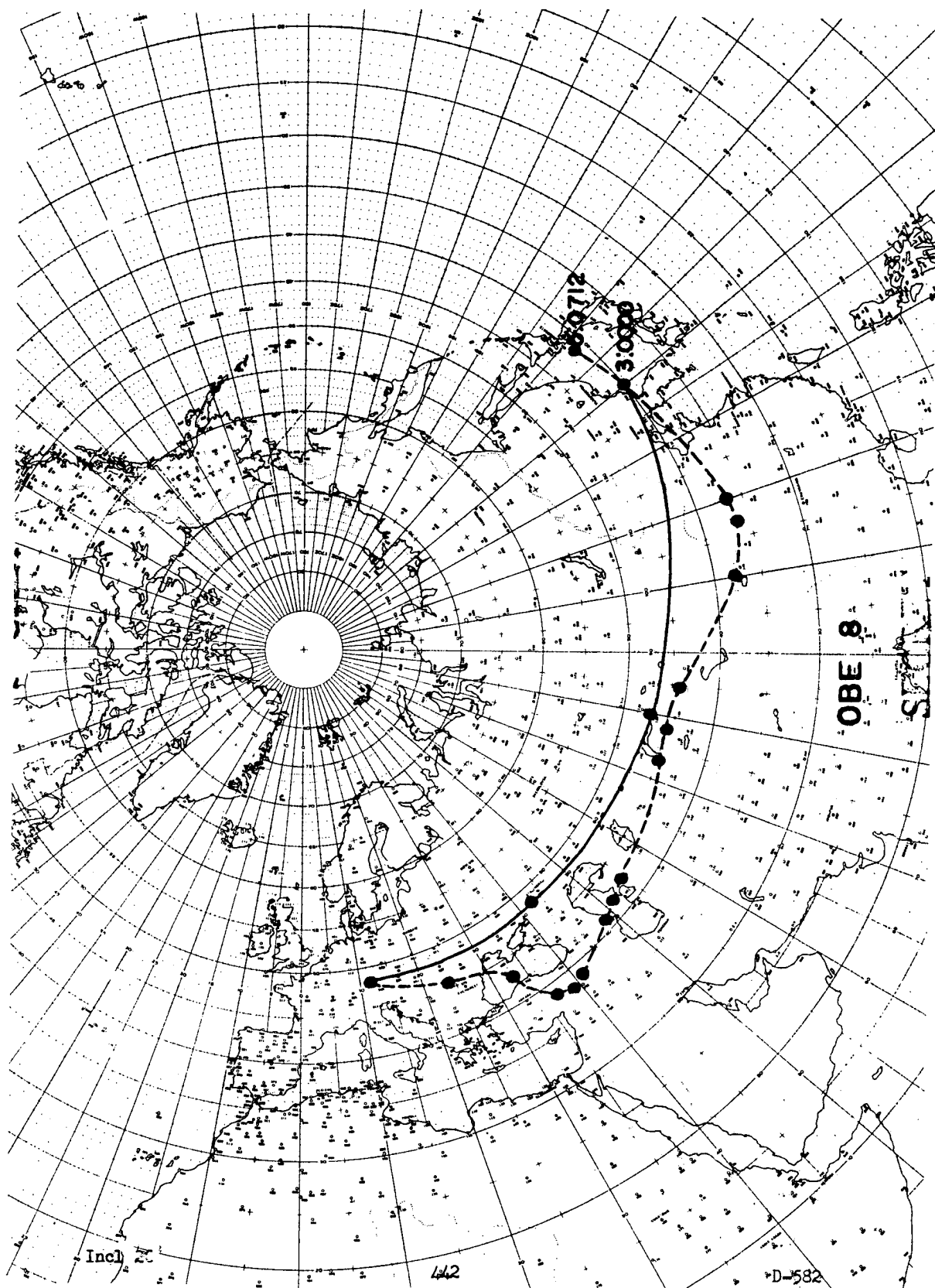
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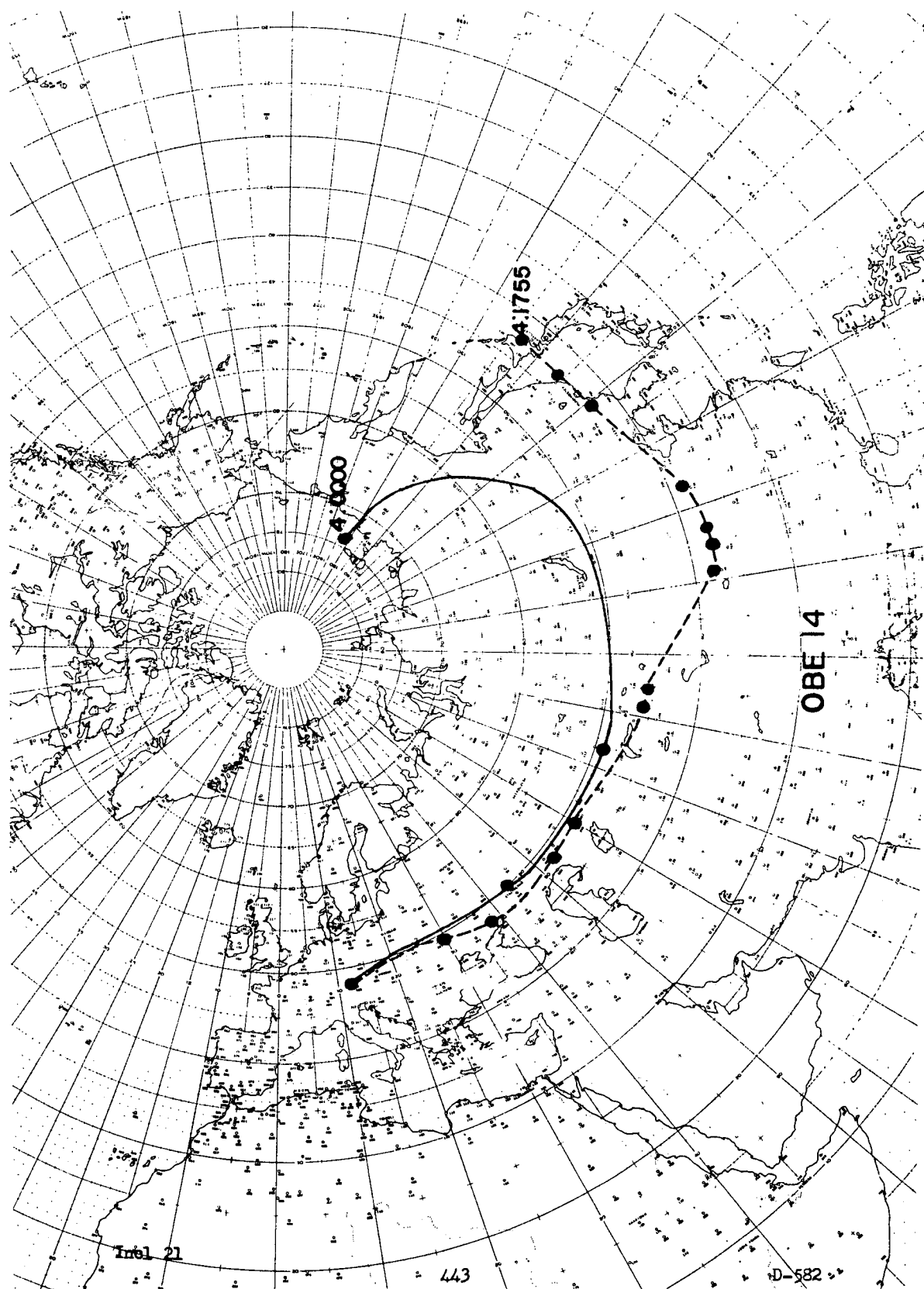
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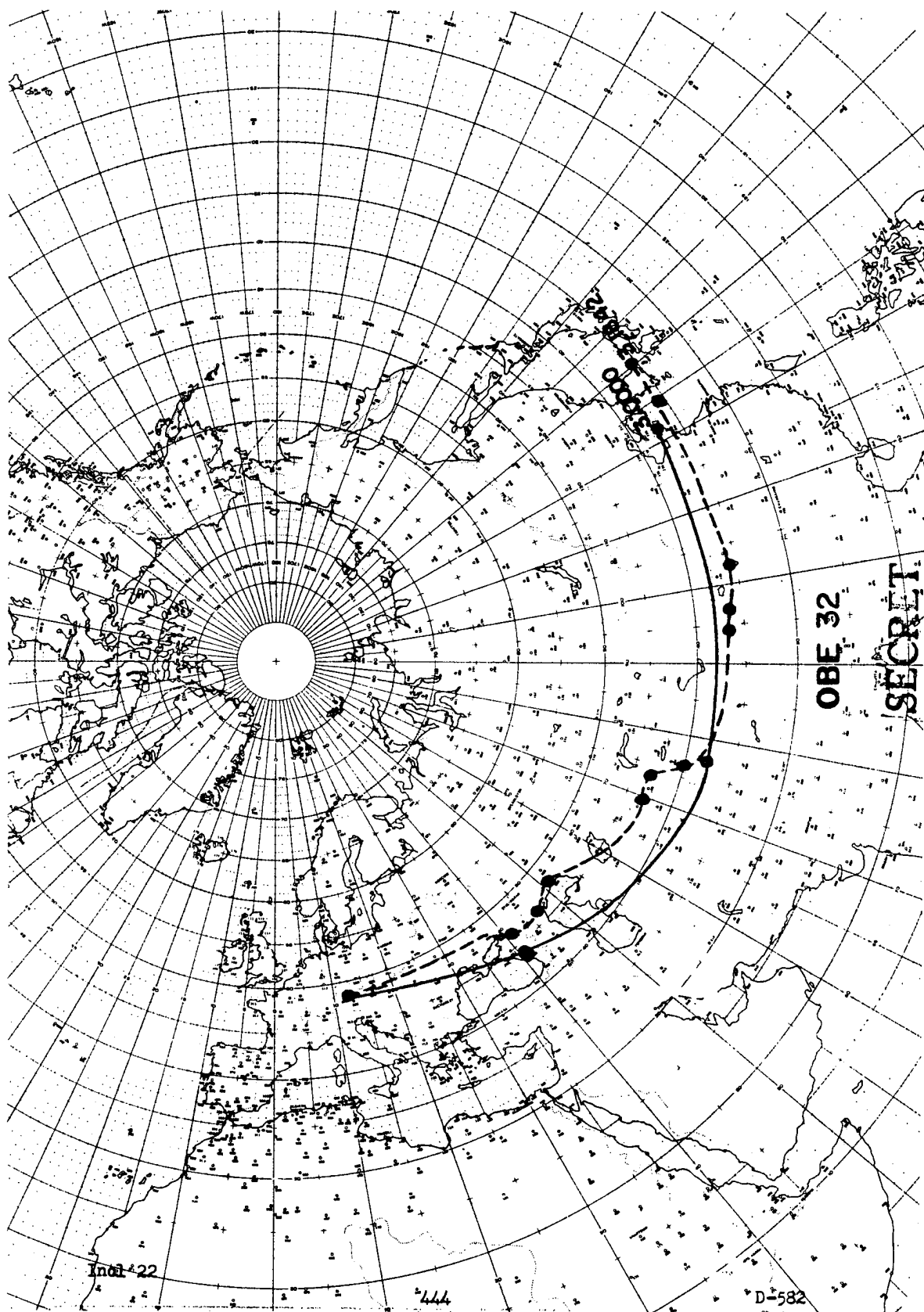
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PART VII

LOSSES OF VEHICLES DUE
TO UNFAVORABLE TRAJECTORIES

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I. LOSSES OF VEHICLES DUE TO UNFAVORABLE TRAJECTORIES

A. This part estimates the degree to which unfavorable winds aloft at the operational balloon levels during the period 10 January to 6 February 1956, have affected the success of Project 119L. From climatological studies, it was expected that 27 per cent of all balloons successfully launched would, due solely to the variable behavior of the wind currents, arrive after seven day's travel in a region where recovery could not be effected. (S)

B. Two methods were employed to arrive at this estimate:

1. Operational statistics were analyzed to determine the number of vehicles lost due to causes other than unfavorable trajectories. The difference, then, represented losses possibly due to unfavorable trajectories. (S)

2. Seven-day trajectories from each launch site for each day of the operational period (from "hindcast" computations) were classified as "good" or "bad" depending upon whether they indicated balloon travel to a "recovery area". The total of balloons actually launched from all sites on "bad days" represents the (theoretical) loss due to unfavorable trajectories. (S)

C. Reference paragraph IB1, above, the number of balloons lost due to poor trajectories is equal to the total launched minus: (S)

1. Those terminated in the recovery area. (S)

2. Those failing on ascent. (S)

3. Those which were heard, but for some reason ceased to transmit in less than 7 days after launch and before being terminated by friendly action, (or which transmitted for at least 7 days, were in the recovery area, but for some reason were not terminated). (S)

4. Those which were launched close enough in time to those in paragraph 3, above, that they would have followed similar paths and hence should have been heard but for some reason were not. (S)

5. Those from which the only transmission received was either a termination signal or "early" transmission. (S)

6. Those which were never heard from, were not launched close in time to others which were heard from, but which probably did not endure for a minimum of seven days. (S)

The basic work sheets from which the tabulations concerning items 1, 2, 3, 4, and 5 above were extracted are attached as inclosure 1 to this part. (U)

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D. Computations leading to the first estimate of balloons lost due to unfavorable trajectories is presented below: (S)

	OBE	ADA	GAR	EVA	GIE
Balloons launched	107	165	34	103	107
Terminated in Recovery Area	<u>7</u>	<u>36</u>	<u>0</u>	<u>1</u>	<u>5</u>
Difference	100	129	34	102	102
Failed at launch	<u>24</u>	<u>17</u>	<u>8</u>	<u>37</u>	<u>34</u>
Difference	76	112	26	65	68
Heard from but transmission ceased in less than 7 days	<u>14</u>	<u>16</u>	<u>8</u>	<u>7</u>	<u>18</u>
Difference	62	96	18	58	50
Launched close in time to those above; never heard from	<u>19</u>	<u>38</u>	<u>6</u>	<u>12</u>	<u>14</u>
Difference	43	58	12	46	36
Termination signal; premature transmission	<u>7</u>	<u>7</u>	<u>0</u>	<u>4</u>	<u>5</u>
Difference	36	51	12	42	31
Grand Total:	172				

E. Reference paragraph C6, above, certain balloons of the 172 arrived at in the preceding paragraph probably did not survive for 7 days and their loss consequently was not due to unfavorable trajectories. The method employed to estimate this percentage consisted of an analysis of the "effective" life of those balloons which were heard from at least once but which were either never terminated in the recovery area or which were terminated at some time greater than seven days after launch. "Effective" life is defined as the time between launch and last transmission. The results of this investigation are tabulated below. The work sheet from which the tabulations were compiled is attached as inclosure 2 to this part. (S)

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EFFECTIVE LIFE (DAYS). NUMBER OF VEHICLES IN EACH CATEGORY

	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	Total
OBE	1	4	3	6							19
ADA	9	2	3	1	2						17
CAR		2	4	1	1	1	3				12
EVA		1	1	2	1						5
GIE		4	5	7	1	1		1		1	20
Total	10	13	21	17	5	2	3	1		1	73

46 of the 73 balloons in the sample (or approximately 90%) had effective lives of less than 7 days. If this figure is representative also of the 172 balloons arrived at in paragraph D, above, then only 16 of the latter would have had lives as long as 7 days and hence could be considered lost due primarily to unfavorable trajectories. (S)

F. It is appropriate, however, to speculate on what the effect of bad trajectories would have been if all the balloons had lived a minimum of seven days, had all functioned perfectly and had been terminated successfully. This effect may be estimated by classifying the hindcast trajectories for each day as "good" or "bad" and considering the total of balloons launched from each site as "recovered" or "lost", respectively. On this basis it is estimated that losses due to unfavorable trajectories would have been as follows at each site:

GIE 29% ADA 10% CAR 83% EVA 79% OBE 15%

The very poor (theoretical) results from CAR and mediocre results from EVA were due to the high incidence of trajectories from these sites which curved north into the polar basin. Without regard to site, the total (theoretical) loss is computed to be 29%. Had there been a volume of launchings from CAR comparable with that of the other sites, this figure would be considerably larger. (S)

G. This analysis has concerned itself exclusively with what the attriting effect of horizontal wind currents has had on the success of the operation. The following factors, to undetermined degree, have apparently played a major part in the attrition of vehicles. (U)

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1. Leaking balloons, undetected at launch or with leaks developing subsequent to launch. (U)
2. Mechanical or electrical malfunction. (U)
3. Enemy action. (S)
4. Overexpenditure of ballast due to radiative effects and/or to turbulence in the atmosphere. (U)

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	Launch Failures	Terminated in Recovery Area	Not Terminated, Heard From but Transmission Ceased in less than 7 Days (Balloons Which Ceased Transmission in Recovery Area, but Not Recovered, Shown in Lower Right Boxes)	Launched Within ± 6 hours of Other Balloons Heard From or Terminated	Remainder
OBE	2,10,13, 22,23,24, 25,26,37, 39,43,47, 5	3,4,8,14,32	6,7,9,11,12,16,18,29	1,19,20,27,28,30, 31,17,21	33,34,35, 36,38,40, 41,42,44, 45,46,48, 49
ADA	1,2,9,23, 24,42,43, 45,46,49, 50,78,92, 94,64, 450	3,4,5,6,7,28, 29,36,37,38, 39,40,44,47, 48,51,52,53, 54,56,58,59, 60,61,62,65, 66,67,69,71, 77,85,87,88, 89	11,16,17,18,25,30,32, 33,34,41,57,86	8,10,19,20,31,35, 55,63,70,72,73, 74,75,76,22,26,27, 79,80,81,82,83,84, 90	12,13,14, 15,21,91, 93,95,96, 97,98,99, 100,101
GAR	2,4,9,12, 13,14		18,20,21,22,26,27,28, 29	10,19,23,24,25,7,	1,3,15,16, 17
EVA	1,3,4,5, 6,7,12,18, 20,21,30, 33,34,40,14, 15		9,10,32	35,36,37,40,41,42, 43,44,45	2,8,11,13, 16,17,19,22, 24,25,26,27, 28,29,31,38, 39

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Launch Failures	Terminated in Recovery Area	Not Terminated, Heard From but Transmission Ceased in less than 7 Days (Balloons Which Ceased Transmission in Recovery Area, but Not Recovered, Shown in Lower Right Boxes)	Launched within ± 6 Hours of Other Balloons Heard From or Terminated	Remainder
2,4,5,6, 7,8,9,17, 18,21,22, 24,30,33, 34,44,46,47	1, 10, 23,31, 32	3,16	11,12,14,15	19,20,25,26, 27,28,29,35, 36,37,38,39, 40,41,42,43, 45

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	Launch Failures	Terminated Recovery Area	Not Terminated, Heard From but Transmission Ceased in Less Than 7 Days	Launched within 6 Hours of Other Balloons Heard from or Terminated	Termination Signal or Premature Transmission	Remainder
OBE	50,62,69,71,76,78,79,85,90,93,97	55,57	52,61,80,81,83,106,	51,56,58,59,60,74,75,82,84,107	53,54,65,73,77,87,96	63,64,66,67,68,70,72,86,88,89,91,92,94,95,98,99,100,101,102,103,104,105,
ADA	134,154	142	122,123,124,133	125,126,127,128,129,130,131,132,136,137,138,140,141	107,112,114,115,139,156,162	102,103,104,105,106,108,109,110,111,113,116,117,118,119,120,121,135,143,144,145,146,147,148,149,150,151,152,153,155,157,158,159,160,161,163,164,165
GAR	31,34					30,32,33
EVA	51,56,57,60,61,62,63,65,66,67,69,70,72,86,87,90,96,98,99,102,103	50	46,48,49,73	47,52,71	84,85,88,93	53,54,55,58,59,64,68,74,75,76,77,78,79,80,81,82,83,89,91,92,94,95,97,100,101

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Launch Failures	Terminated Recovery Area	Not Terminated, Heard From but Transmission Ceased in Less Than 7 Days	Launched within $\pm$ 6 Hours of Other Balloons Heard From or Terminated	Termination Signal or Premature Transmission	Remainder
61, 71, 73, 74, 75, 76, 77, 78, 79, 82, 84, 85, 88, 97, 101, 107		58, 51, 52, 53, 54, 56, 57, 58, 59, 81, 83, 92, 93, 100, 102, 105	49, 50, 55, 60, 89, 90, 99, 103, 104, 106	62, 65, 80, 91, 98	63, 64, 66, 67, 68, 69, 70, 72, 86, 87, 94, 95, 96

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Balloons Heard From But Not Terminated (or Terminated After Over 7 Days Flight)

Time After Launch Last Transmission Received (Days-Hours-Minutes)

BALLOON	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	8 - 9	9 - 10	10 - 11	Over 11
OBE 6			4:1018							
9	2:2029									
11				5:0314						
12			4:1405							
14			4:1753							
16			4:0913							
18				5:0605						
29			4:1516							
32		3:1842	4:2111							
52				5:0841						
55				5:0821						
57				5:1440						
61										
73		3:1534								
80		3:1818								
81			4:0356							
83		3:2319	4:1912							
106										
ADA 11			4:0955		6:1137					
16				5:0635						
17			4:1007							
18										
25	2:1550									
30	2:1105									
32	2:1545									
33	2:2045									
34			4:1055							
41								6:0311		
57	2:1027									
83	2:0318									
122	2:0318									

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Time After Launch Last Transmission Received (Days-Hours-Minutes)

BALLOON

ADA 123 2:0246

2:0240

2:0210

99

GAR

Σ76T:2

8:1804

8:1637

8:0505

6:1945

4:2050

5:1354

3:1427

455

4:2146

4:1815

57771:7

3:0621

5:0623

EVA

9071:7

5:1412

5:2107

6:0520

3:0256

GIE

9:0111

7:1232

D-

4:2304

4:2341

3:0810

4:01:02

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Balloons Heard From But Not Terminated (or Terminated After 7 Days Flight)

Time After Launch Last Transmission Received (Days-Hours-Minutes)

BALLOON	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	8 - 9	9 - 10	10 - 11	Over 11
GIE 29										11:1006
48		3:1612								
51				5:0434						
52				5:1910						
53				5:1649						
54				5:0505						
56				5:1110						
57				5:1408						
58				5:0636						
59						6:0540				
81			4:0235							
83		3:1942								
92		3:1142								
93			4:1705							

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PART VIII.

ACCURACY OF CLIMATOLOGICAL ESTIMATE

OF LAUNCH SITE WEATHER AND

FAVORABLE INITIAL TRAJECTORIES

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I. ACCURACY OF CLIMATOLOGICAL ESTIMATES OF LAUNCH SITE WEATHER AND FAVORABLE INITIAL TRAJECTORIES

A. This Part compares the climatologically-predicted percentage of the time that (1) favorable launching weather and (2) a combination of favorable launching weather and favorable initial trajectory would obtain at the several sites with their "actual" occurrence as estimated from daily forecasts. This is in no sense a rigorous evaluation since neither continuous weather observations from the sites nor observed trajectories are available and since launchings were made, in many cases, under previously defined "adverse" weather conditions. (C)

B. From the record of daily forecast surface and trajectory conditions maintained by the Comptroller the following tabulation of total days of weather and trajectory forecasts within the categories Good, Marginal, and Unfavorable, was extracted: (S)

	Surface Weather			Initial Trajectory		Overall Site Operability		
	Good	Margl	Unfav	Good	Unfav	Cpnl	Margnl	Non-Cpnl
CBE	13	12	2	25	2	11	12	4
ADA	15	11	1	27	0	15	11	1
GAR	11	9	7	18	9	9	5	13
EVA	7	8	12	22	5	7	5	15
GIE	13	9	5	26	1	12	9	6

C. Assuming that a marginal day is exactly half operational and half non-operational, the tabulations of surface weather and overall site operability become: (S)

	Surface Weather			Overall Site Operability		
	Good	Unfav	%Good	Good	Unfav	%Good
CBE	19	8	70.5%	17	10	63.5%
ADA	20.5	6.5	76.0	20.5	6.5	76
GAR	15.5	11.5	75.5	11.5	15.5	42.6
EVA	11	16	40.7	9.5	17.5	35.2
GIE	17.5	9.5	64.3	16.5	9.5	61

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D. The estimates of the percentage of favorable surface weather derived from climatology were as follows:

OBE 67% ADA 83% CAR 60% EVA 40% GIE 60%

Generally good agreement is noted. (S)

5. A planning study on the same subject prepared for this headquarters by the 2d Weather Wing Technical Services Division at Rhein-Main Air Base estimated an almost identical incidence of favorable surface weather, and, in addition, estimated the incidence of operation time based on expectancy of favorable surface weather and favorable upper air trajectories. Since criteria for the latter included the restriction that trajectories penetrate the target area north of 42°N, the computed expectancy of favorable trajectories is much lower than that actually realized. (S)

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PART IX
EVALUATION OF WEATHER
CONDITIONS IN RECOVERY AREA

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I. EVALUATION OF WEATHER CONDITIONS IN RECOVERY AREA

A. This part compares the terminal and flying weather actually experienced at the several recovery bases and in the recovery area during the period 8 January - 10 February 1956 with predictions made from climatology. (S)

B. Below-minimum terminal conditions were experienced at recovery bases the following percentage of the time (from project W-1 reports from 456th Troop Carrier Wing): (S)

Week	Kadena	Johnson	Misawa	Itazuke	Adak	Kodiak
8-14 Jan	0	2	14	3	0	0
15-21 Jan	3	1	12	6	35	2
22-28 Jan	0	13	2	1	10	5
29 Jan-3 Feb	1	0	27	0	3	9
4-10 Feb	1	1	8	1	7	12
	5	17	63	11	55	28
Average %	1.0	3.4	12.6	2.2	11.0	5.6

At recovery bases, terminal weather was considered below minimum if the ceiling or visibility were less than the following values: (S)

Recovery Base	Day	Night
Kadena	500-1	500-2
Johnson	500-1	500-2
Misawa	500-1	500-2
Itazuke	500-2	500-3
Adak	500-2	500-3
Kodiak	500-2	500-2

C. Climatological prediction indicated the following percentage of below minimum conditions: (S)

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Month	Kadena	Johnson	Misawa	Itazuke	Adak	Kodiak
Jan	0.3	2.3	7.0	1.4	3.4	5.6
Feb	<u>0.4</u>	<u>3.9</u>	<u>6.5</u>	<u>3.0</u>	<u>3.6</u>	<u>9.2</u>
Average %	0.4	2.9	6.8	2.1	3.5	7.1

(2/3 Jan; 1/3 Feb)

D. The comparative data are presented graphically in inclosure 1. The high incidence of bad weather at Adak and Misawa was due to one particular bad week at each place. Much better agreement with climatology should have been realized if the operational period had been longer. (U)

E. Weather conditions unfavorable to aerial recovery operations occurred the following percentage of the time in the indicated sub-regions of the recovery area. (Project W-1 reports from 456th Troop Carrier Wing). Sub-regions are identified on inclosure 2. (S)

Sub-Region

Week	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
8-14 Jan	34	16	80	53	35	25	23	37	33	40	36	21	0	32	60	3	18	43	10	3
15-21 Jan	17	12	80	39	24	27	21	2	8	25	52	60	66	17	46	43	21	36	8	12
22-28 Jan	7	25	46	35	11	5	1	8	9	25	35	37	31	18	6	20	3	38	1	11
29 Jan - 3 Feb	7	13	20	31	24	11	9	7	8	36	21	50	47	30	40	19	30	40	10	40
4-10 Feb	6	12	24	38	21	39	15	16	38	30	48	7	5	15	25	2	6	20	10	20
	71	250	115	69	96	192	149	177	78	39										
	78	196	97	70	156	175	112	87	177	86										
Average	14	16	50	39	23	17	14	14	19	31	38	35	30	22	35	17	16	35	8	17

In the sub-regions, unless the pilot had at least 5,000 feet of clear or scattered conditions with visibility over five miles in which to attempt recovery, and scattered to broken conditions above flight level for visual sighting of balloon before cut-down, the area was classified as restricted. (S)

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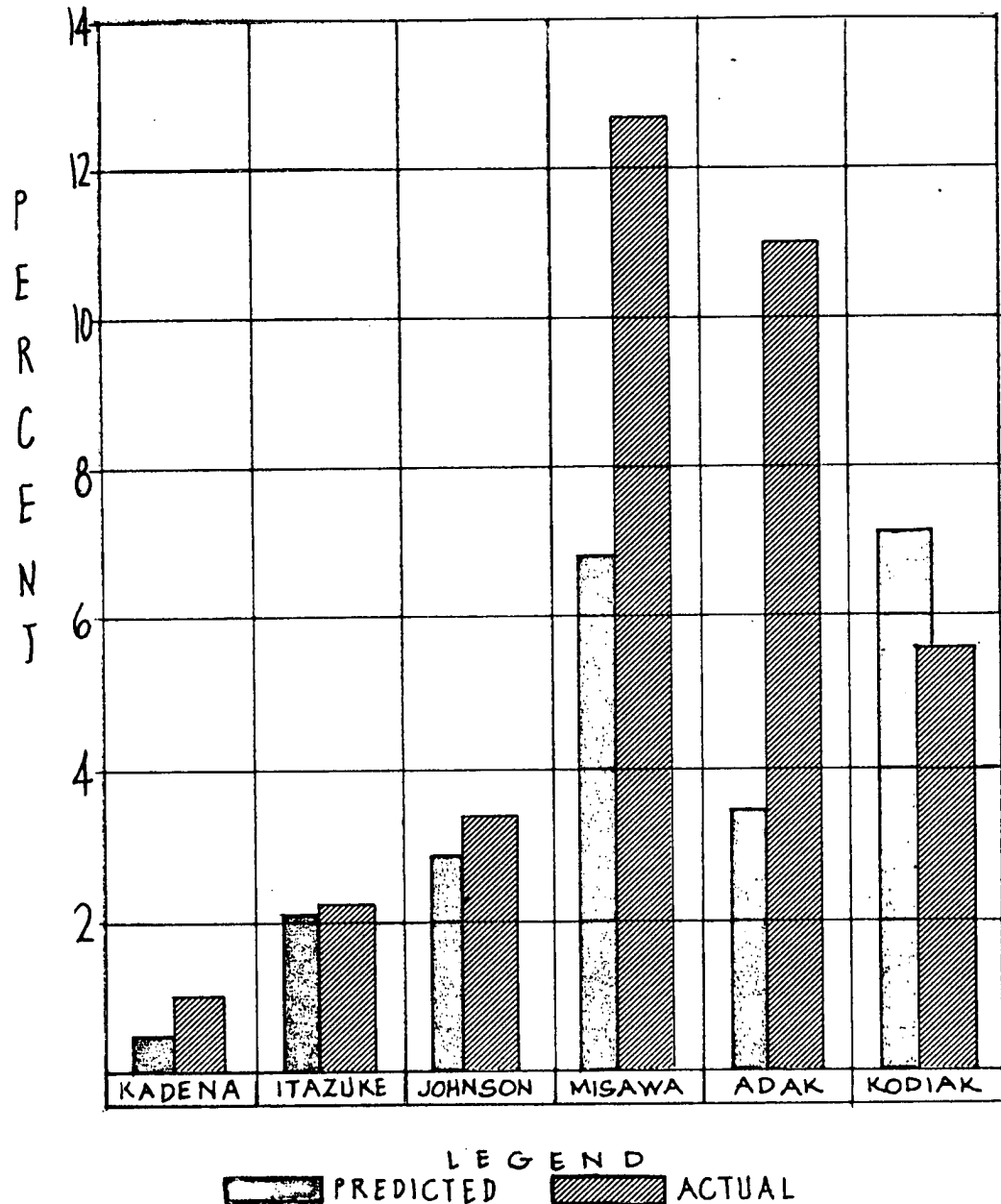
F. Inclosure 3 indicates the predicted incidence of unfavorable recovery weather. On Inclosure 4, the average observed incidences of unfavorable recovery weather have been plotted within appropriate sub-regions and isopleths of this quantity have been drawn. A comparison of the two indicates generally good agreement. Somewhat poorer conditions over a larger area were observed than were predicted by climatology, probably because the latter estimate is an average over a period including late autumn and early spring when considerably better weather would be expected than in mid-winter. (C)

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TERMINAL WEATHER RESTRICTIONS

10 JAN to 11 FEB '56



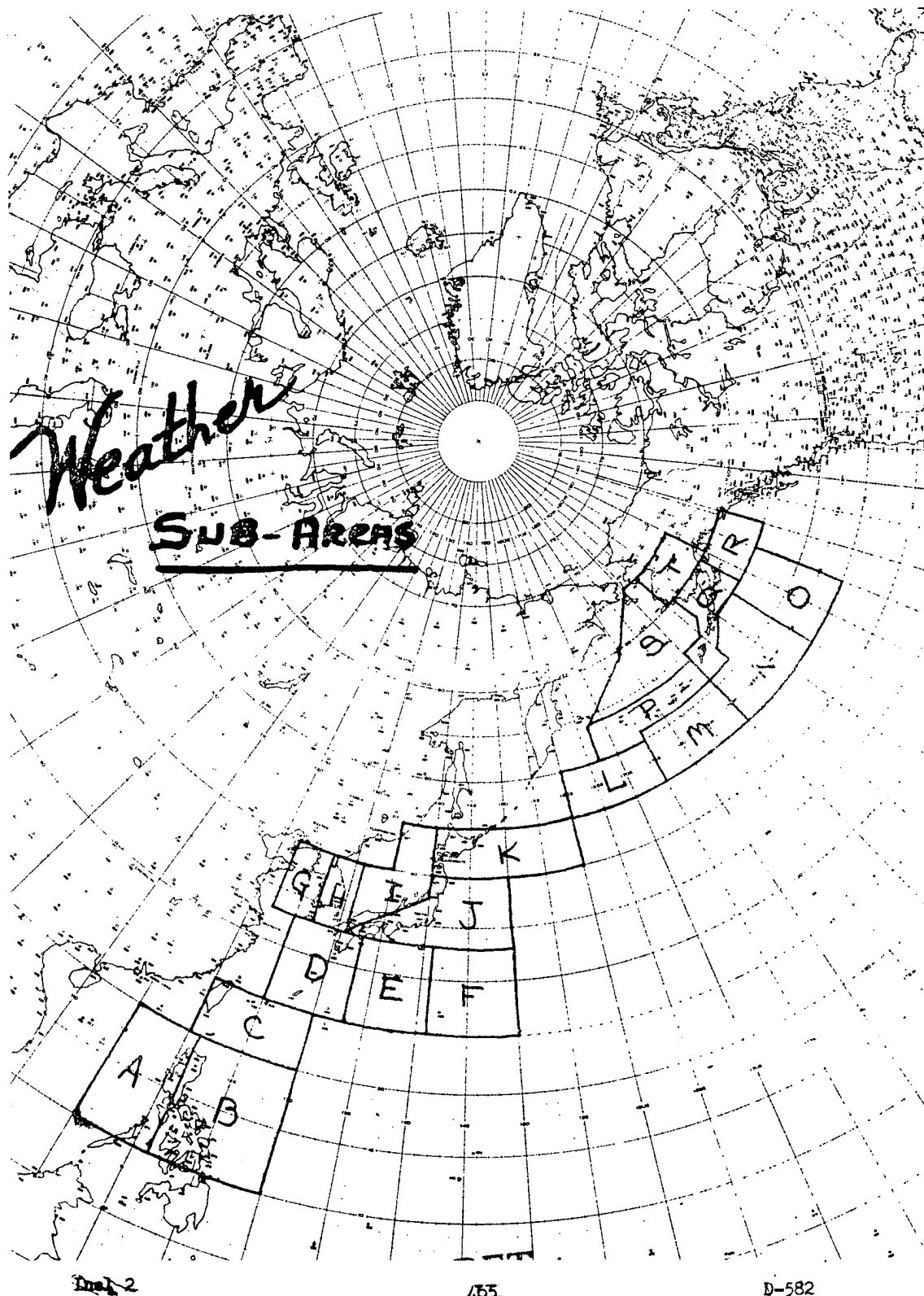
Incl 1

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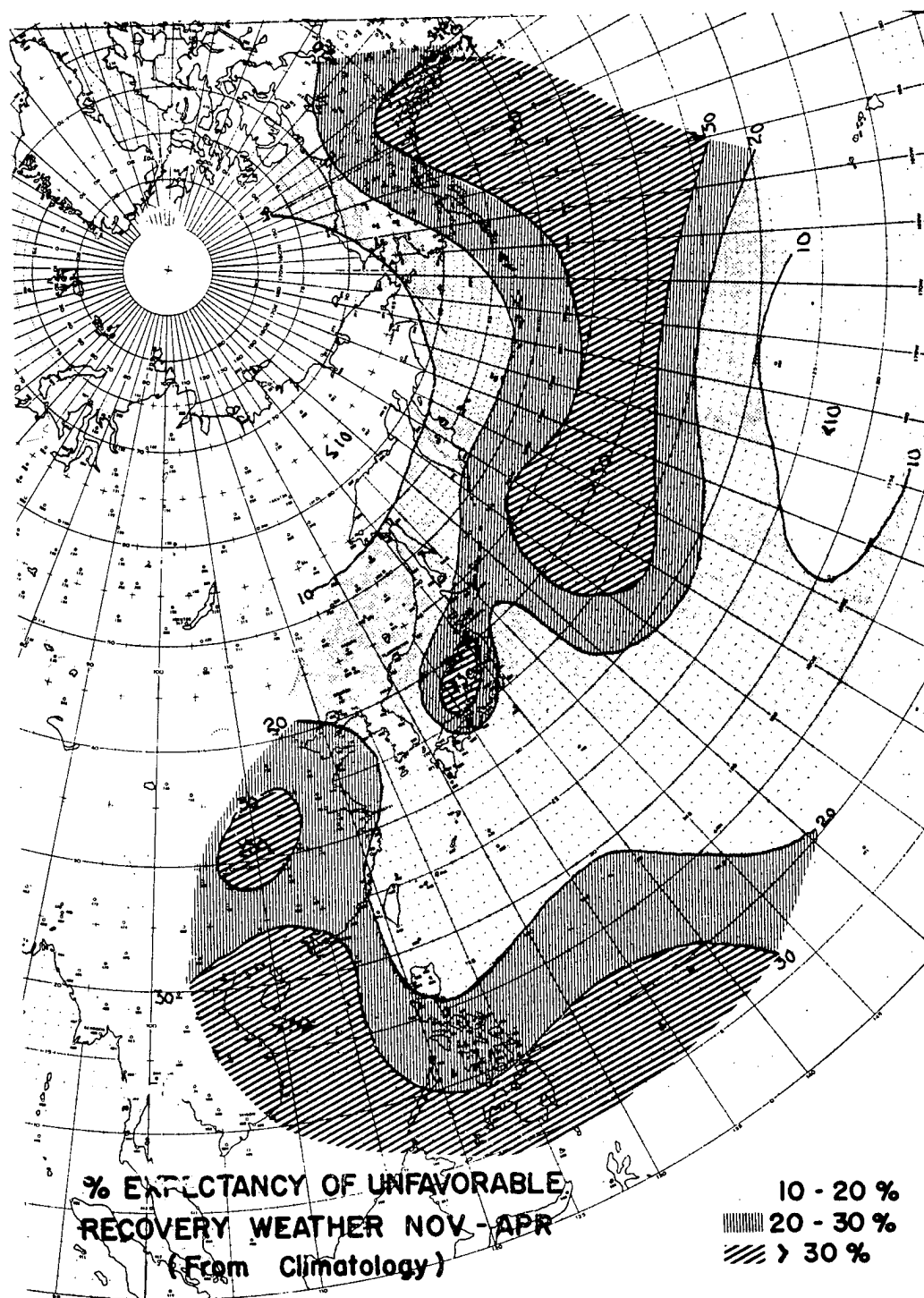
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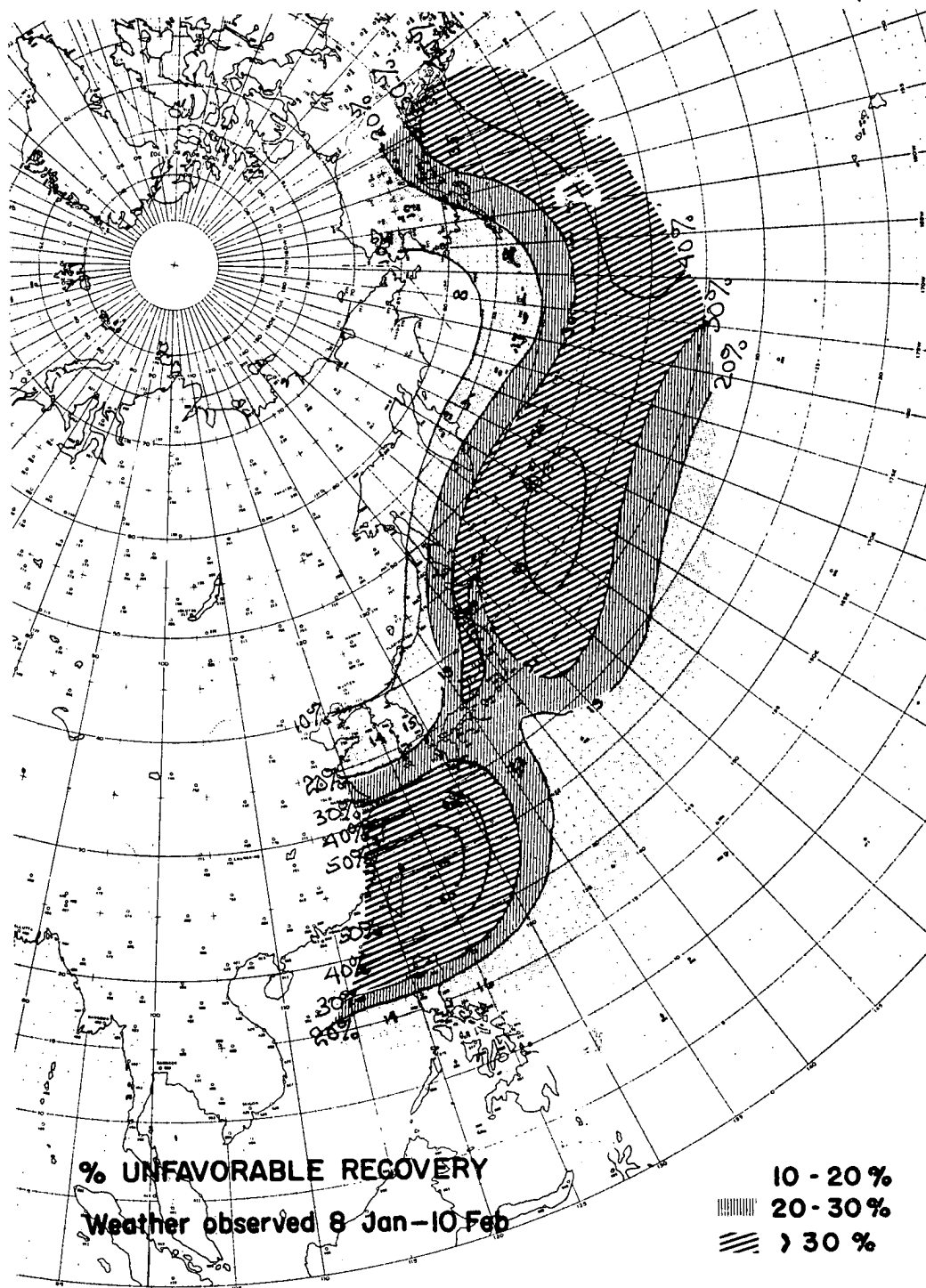
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Incl 4

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PART X

FORECASTABILITY AND RELIABILITY

OF CURRENT TRAJECTORY LAUNCH

CRITERIA

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I. FORECASTABILITY AND RELIABILITY OF CURRENT TRAJECTORY LAUNCH CRITERIA

A. This part presents "box scores" of forecast accuracy achieved by High Wycombe in predicting go/no-go situations in accordance with the trajectory criteria prescribed by this headquarters. Secondly, it presents the reliability of the criteria themselves as indicators of whether or not a subsequent successful trajectory will ensue. Finally, it discusses certain implications of the results presented. (C)

B. The following are tabulations of forecast versus observed (per hindcast) "go" and "no-go" situations for each site. Numbers in the upper left plus lower right boxes are successful forecasts; in the other boxes, missed forecasts. (S)

		OBSERVED		% ACCURACY
		GO	NO/GO	
Oberpfaffenhofen	Forecast	GO 26	0	26/28 = 93
	No Go	2	0	
Adana	Forecast	GO 28	0	28/28 = 100
	No Go	0	0	
Gardermoen	Forecast	GO 17	2	22/28 = 78
	No Go	4	5	
Evanton	Forecast	GO 21	2	22/28 = 78
	No Go	4	1	
Giebelstadt	Forecast	GO 26	1	26/28 = 93
	No Go	1	0	

C. As seen from the tabulations of paragraph B, it is possible to predict rather accurately a "go" or "no go" situation as this headquarters has defined it. The high scores achieved are probably due in large measure to the "looseness" of the criteria. In other words, "favorable conditions" occur most of the time at the levels and during the month in question. (U)

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D. The following are tabulations of "actual" (hindcast) initial trajectories versus subsequent successful trajectories (hindcasts) for each site. (S)

		SUBSEQUENT	
		Successful	Unsuccessful
Oberpfaffenhofen	Initial	GO 26	2
		No Go 0	0
		% of Accuracy 26/28 = 93%	

		SUBSEQUENT	
		Successful	Unsuccessful
Adana	Initial	GO 26	2
		No Go 0	0
		% of Accuracy 26/28 = 93%	

		SUBSEQUENT	
		Successful	Unsuccessful
Gardermoen	Initial	GO 11	11
		No Go 2	4
		% of Accuracy 15/28 = 53.5%	

		SUBSEQUENT	
		Successful	Unsuccessful
Evanton	Initial	GO 13	12
		No Go 2	1
		% of Accuracy 14/28 = 50%	

		SUBSEQUENT	
		Successful	Unsuccessful
Giebelstadt	Initial	GO 22	6
		No Go 0	0
		% of Accuracy 22/28 = 79%	

E. A favorable initial trajectory from Adana, Giebelstadt, and Oberpfaffenhofen appears to be a reliable predictor of a subsequent successful trajectory. Little real confidence can be placed on this finding, though, because the great majority of all subsequent trajectories were successful trajectories. The evaluation would be more meaningful if there had been an equal number of successful and unsuccessful subsequent trajectories. From the tabulations it is seen that an initial favorable/unfavorable trajectory from Evanton or Gardermoen is no indication at all of whether the subsequent trajectory will be successful. It must be remembered, however, that the criteria were established only to preclude wasteful launches when very obvious unfavorable conditions obtained. The fact that the period of operations was one containing practically no such cases renders an evaluation of the effectiveness of the criteria indeterminate. (S)

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CHAPTER V

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DOCUMENTS

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I. REFERENCE DOCUMENTS.

A. Establishing Directives:

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2. USAF Letter to United States Air Force in Europe, Subject: "Assignment of Additional Function to United States Air Force in Europe", dated 3 November 1954.
3. USAF Letter to United States Air Force Security Service, Subject: "Assignment of an Additional Function to United States Air Force Security Service", dated 23 November 1954.
4. USAF Letter to Tactical Air Command, Subject: "Proposed Plan for Recovery Function", dated 15 December 1954.
5. USAF Letter to Headquarters Command, Subject: "Assignment of Additional Function", dated 21 December 1954.
6. USAF Letter to Alaskan Air Command, Subject: "Communications Support for Project (C) (codeword)", dated 23 December 1954.
7. USAF Letter to Headquarters Command, Subject: "Responsibilities for Project (C) (codeword)", dated 29 December 1954.
8. USAF Letter to Aeronautical Chart and Information Center, Subject: "Proposed Plan for the Data Reduction Function of Project (C) (codeword)", dated 31 December 1954.
9. USAF Letter to Strategic Air Command, Subject: "Assignment of Additional Mission to Strategic Air Command", dated 21 March 1955.
10. USAF Letter to Far East Air Forces, Subject: "Assignment of Additional Function to Commander Far East Air Forces", dated 23 March 1955.
11. SAC General Order Number 26, Subject: "Activation of the 1st Air Division", dated 15 April 1955.

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12. SAC Regulation Number 23-7, Subject: "Mission - 1st Air Division", dated 15 June 1955.
13. 1st Air Division General Order Number 1, Subject: "Assumption of Command by General W. P. Fisher", dated 15 April 1955.
14. 1st Air Division General Order Number 2, Subject: "Organization of Detachment Number 1, Headquarters 1st Air Division", dated 9 June 1955.

B. Deployment Directives:

1. Launch Units (1110th Air Support Group).
 - a. USAF Movement Directive, dated 17 June 1955.
 - b. Headquarters Command Movement Orders, 1110th Air Support Group, dated 23 June 1955.
 - c. 1110th Air Support Group Movement Order (TDY) 2-55, Code ASG EMO-1, 1 June 55, TDY No way.
 - d. 1110th Air Support Group Order 5-55, dated 13 September 1955.
 - e. 1st Air Division Operations Order 227-55, dated 31 August 1955.
2. Recovery Units (456th Troop Carrier Wing (M)).
 - a. USAF Movement Directive, dated 17 June 1955.
 - b. Headquarters 18th Air Force Movement Order, 456th Troop Carrier Wing, dated 23 June 1955.
 - c. 1st Air Division Operations Order 226-55, dated 1 September 1955.
 - d. 456th Troop Carrier Wing Operations Order 1-55, dated 22 August 1955.
3. Tracking Units (6926th Radio Squadron (Mobile)):
 - a. USAFSS Movement Order, 6926th Radio Squadron (Mobile), Shipment 0283-A.

C. Documents Governing Operations:

1. USAF Operational Concept, not dated.

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2. USAF Military Characteristics for Balloons, dated 4 October 1954.
3. USAF Stray Recovery Plan, dated 15 December 1955.
4. 1st Air Division Manual, Subject: "Procedures and Techniques for Data Recovery (AN/DMQ-1)", dated September 1955.
5. 1st Air Division Manual, Subject: "Procedures and Techniques for Data Recovery (AN/DMQ-2)", dated October 1955.
6. 1st Air Division Operations Plan 1-55, ZI Operational Suitability Test Plan (OST), dated 27 April 1955.
7. 1st Air Division Manual 55-8 - Reporting Guide.
8. 1st Air Division Manual 55-9 - Instrumentation.
9. 1st Air Division Manual 55-10 - Launch Tactical Doctrine.
10. 1st Air Division Manual 55-11 - Recovery Tactical Doctrine.
11. 1st Air Division Operations Order 201-55, Operational Suitability Directive (OST), dated 5 May 1955.
12. 1st Air Division Operations Order 202-55, Moby Dick Far East (MDFE) Training Directive, dated 29 July 1955.
13. 1st Air Division Operations Order 203-55, Command Post Exercise (CPX).
14. 1st Air Division Operations Order 204-55, Command Post Exercise (CPX).
15. 1st Air Division Operations Order 205-55, Command Post Exercise (CPX).
16. 1st Air Division Operations Order 206-55, Command Post Exercise (CPX).
17. 1st Air Division Operations Order 207-55, Subject: "White Cloud", dated 4 February 1956, cover launches in Far East.

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18. 1st Air Division Operations Order 250-55, Subject: "Primary Mission", dated 14 October 1955.
 19. 1110th Air Support Group Operations Order 1-55, Command Post Exercise (CPX) (Launch).
 20. 1110th Air Support Operations Order 204-55, Command Post Exercise (CPX).
 21. 1110th Air Support Group Operations Plan 4-55, Detachment Re-deployment.
 22. 1110th Air Support Group Operations Order 250-55, Primary Mission (Launch).
 23. 456th Troop Carrier Wing Operations Order 1-56, Limited D/F Capabilities.
 24. 456th Troop Carrier Wing Operations Order 250-55, Primary Mission (Recovery).
 25. 6926th Radio Squadron (Mobile) Unit Mobility Plan, Serial Number 1.
 26. 6926th Radio Squadron (Mobile) Operations Plan 1-55, Moby Dick Far East Training.
 27. 6926th Radio Squadron (Mobile) Operations Order 2-55, Tracking of 119L Balloons.
 28. 6926th Radio Squadron (Mobile) Training Guide.
 29. 6926th Radio Squadron Manual of Operations.
- D. Directives Issued by Supporting Commands:
1. Department of the Navy, Naval Participation Plan.
 2. USAFE Operations Plan 55-119L, Support Plan.
 3. USAFE Operations Plan 55-119L, Annex "B" (Revised)
 4. FEAF Operations Plan 26-55, Support Plan.
 5. AAC Operations Order 12-55, Support Plan (Recovery).
 6. AAC Special Plan X-55, Stray Recovery.

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7. AAC Logistics Plan 4-55A, Logistical Support Plan.
8. TAC Operations Plan 5-55, Support Plan (Recovery).
9. AMFE Plan 55-119L, Logistical Support Plan.
10. 3d Air Force Operations Plan GB-7-55, Support Plan.
11. 5th Air Force Operations Plan 26-55, Administrative and Logistical Support Plan.
12. 12th Air Force Operations Plan 103-55, Air Traffic Procedure (Project 119L).
13. USAFSS Operations Plan 6-55, Establishing of HF/RDF System, dated 1 February 1955.
14. USAFSS Operations Plan 6A-55, Establishing of HF/RDF System, dated 1 June 1955.
15. 41st Air Division Operations Plan 26-55, Logistical Support.
16. 1st Weather Wing Operations Order 26-55, Necessary Weather Facilities and Services.
17. 3d Air Force Rescue Group Operations Plan 26A-55, Support Plan.
18. 3919th Air Base Squadron Special Plan Project 119L, Support of C-119 Aircraft.
19. AACS Communication and Electronics Plan 507-55.

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2. Trip Reports (1st Air Division).
 - a. Staff Coordination Visit of Pacific Area, dated 16 May 1955.
 - b. Visit to European Commands by Brigadier General Fisher and 1st Air Division Staff, dated 28 July 1955.

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c. 1st Air Division Staff Visit to the Alaskan and Far East Areas, 9 October - 1 November 1955, not dated.

d. 1st Air Division European Sites Inspection, 25 November - 1 December 1955, not dated.

F. Equipment Manuals.

1. Parts List for Model G 77 Hydrogen Generator, Gas Equipment Engineering Corporation.
2. 4X System Manual, Electronics Corporation of America.
3. 4U System Manual, Electronics Corporation of America.
4. 4U Operating Manual, Electronics Corporation of America.
5. Bench Test Equipment 35, Tufts University, March 1955.
6. Transmitter 1C-JO, Tufts University, March 1955.
7. Bendix Transceiver MRT-9C, Tufts University, March 1955.
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12. Suspension System Equipment 34, Tufts University, March 1955.
13. Battery Box Preparation and Equipment 35 Packing, Tufts University, March 1955.
14. A System for Heavy Load Launching Manual, General Mills Mechanical Division, dated 23 November 1953.

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H. Miscellaneous.

1. Final Report Project 119L, Detachment 1, 1st Air Division, APO 241, New York, N. Y. dated 1 April 1956.

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CHAPTER VI

IBM MACHINE SUB

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KEY TO MACHINE RUN

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I. Key to Machine Run: This Part contains a description of the codes and column numbers required for deciphering the IBM machine run in Part II this Chapter.

<u>Column Title</u>	<u>Column Numbers</u>	<u>Code and Explanation Digit Indicates</u>
Site and Location	1	Launch detachment number and location as follows: 1. Oberpfaffenhofen 2. Adana 3. Gardermoen 4. Evanton 5. Giebelstadt
Line Number	2-4	3 digit identification code from 1st Air Division Communications Manual 55-9
Launch Number	5-7	Actual launch number from each site in Numerical Sequence
Blank	8	Not used
Vehicle Type	9	1. 66 type balloon 2. 128 type balloon
Camera Manufacturer	10	1. Bill Jack 2. Chicago Aerial 3. Eastman 4. Fairchild 5. Hycon
Launch Time	11-15	Month, day and hour of launch. Zulu Time. 1st digit for month; 2nd and 3rd digits for day and 4th and 5th digits for previous hour. For example: 1827 hours 24 January would be 12418.
Day - Night	16	Breakdown of time of day of launches. 1. Night 2. Morning (dawn) 3. Day 4. Evening (Twilight)

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<u>Column Title</u>	<u>Column Numbers</u>	<u>Code and Explanation Digit Indicates</u>
Balloon Serial Number	17-20	Manufacturers assigned Serial Number
Blank	21	Not used
Gross Weight	22-24	Actual weight in tens of pounds to nearest tenth. For example 1656 actual pounds reads - 166.
Ballast Weight	25-27	In tens of pounds
Percent Free Lift	28-29	Self Explanatory
Programmed Altitude	30-31	In thousands of feet to nearest thousand. Example: 46,300 would show as 46.
Blank	32-33	Not used
H/F radio programmed to turn on	34-37	The day and hour the radio was set to automatically transmit
Camera Programmed to turn on	38-41	The date and hour the camera was set to start operating
Surface Wind	42-43	The actual speed, in knots, of the surface wind at time of launch
Cloud Coverage at Launch	44	0 - Less than 1/8 (Clear) 1 - 1/8 to 4/8 (Scattered) 2 - 5/8 to 7/8 (Broken) 3 - Over 7/8 (Overcast) 4 - Obscured (fog, smoke, precipitation, etc.)

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<u>Column Title</u>	<u>Column Numbers</u>	Code and Explanation Digit <u>Indicates</u>
Temperature	45	Surface temperature, Fahrenheit, at time of launch, broken down in following codes: 0 - 0 to 9 above zero 1 - 10 to 19 above zero 2 - 20 to 29 above zero etc.
Precipitation	46	Breakdown of weather at time of launch, as follows: 0 - No precipitation, good visibility 1 - Fog, temperature above freezing 2 - Fog, temperature below freezing 3 - Drizzle or light rain 4 - Moderate or heavy rain 5 - Light snow 6 - Moderate or heavy snow 7 - Freezing rain, drizzle or sleet 8 - Thunderstorm in vicinity, no precipitation 9 - Thunderstorm in vicinity, accompanied by precipitation
Launch	47	Showing difficulties encountered at launch. (if any) 0 - Rejected or cut away 1 - Normal 2 - Delayed but normal 3 - Marginal launch, no damage probable 4 - Marginal launch, damage probable 5 - Unsuccessful
Balloon Modification or repair	48	Codes listed below are self explanatory 0 - No modification or repair 1 - Modification only 5 - Patched only 6 - Modification and patched

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<u>Column Title</u>	<u>Column Numbers</u>	<u>Code and Explanation Digit Indicates</u>
Maximum Rate of Ascent	49-50	Listed in 100's of feet per minute to nearest 100
How Rate of Ascent Obtained	51	1 - Radiosonde Only 2 - Radar Only 3 - Radar and Radiosonde 4 - Other Means 5 - Estimated
Ascent Success	52	1 - Successful 2 - Questionable 3 - Unsuccessful
Overt Action	53	0 - None Detected 1 - Probable, detected radar 2 - Known, detected radar 3 - Probable, air visual 4 - Known, air visual 5 - Probable, ground visual 6 - Known, ground visual 7 - Known, other
First H/F Radio Signal Heard	54-57	Day of month and hour, Zulu time. Example: If signal heard Jan 24th at 0830 list would show 2408.
Fixes and H/F Signal Heard	58-59	Actual number of fixes shown in column 58, up to nine, over nine are coded nine. Column 59, H/F heard, is in relation to columns 34-37. If heard later than programmed, column 59 will be zero (0). If heard in advance, following codes will apply. 58 - Number of fixes obtained (9 or more will be coded nine)

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<u>Column Title</u>	<u>Column Numbers</u>	<u>Code and Explanation Digit Indicates</u>
Fixes and H/F Signal Heard	58-59	59 - 0 - Not Applicable 1 - Applicable, Unknown 2 - Within 1 hour before programmed 3 - 1 to 3 hours before programmed 4 - 3 to 5 hours before programmed 5 - 5 to 7 hours before programmed 6 - 7 to 9 hours before programmed 7 - Over 9 hours before programmed Columns 58-59 also will carry failure altitude, in event of unsuccessful flight. Any entries in columns 58-59 will be failure altitude (to nearest 1000) if column 66-67 lists an entry of 21 through 28.
Arrived	60	Following codes are self explanatory 0 - Not Applicable 1 - Reached area where termination feasible 2 - Reached friendly area, termination not feasible 3 - Failed to transit 4 - Unknown 5 - Stray
VHF Radio	61	The capability for flight termination hinged on the VHF radio. The following codes are used to show the status of VHF where known.

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<u>Column Title</u>	<u>Column Numbers</u>	<u>Code and Explanation Digit Indicates</u>
VHF Radio	61	0 - Not applicable. Vehicle did not enter area where it could be worked 1 - Failed to work. Vehicle entered recovery area but aircraft could not get VHF to work 2 - Functioned as planned 3 - Functioned intermittently 4 - Functioned then failed, cause unknown 5 - Applicable but unknown. (Vehicle reached recovery area but no attempt was made to work VHF)
Termination Action	62-63	These two columns tell the story of attempts to terminate flights. Self-explanatory codes are listed below. 00 - Not Applicable 01 - Transited, no VHF 02 - Failure, geographic reasons 03 - Failure, weather reasons 04 - Failure, operational reasons 11 - Ground cut down attempted, failed 12 - Air cut down attempted, failed 13 - Ground and air attempted, failed 21 - Air cut down successful 22 - Ground cut down successful 30 - Self termination, terminal signal heard 31 - Self termination, no terminal signal heard 40 - Other action (friendly)

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<u>Column Title</u>	<u>Column Numbers</u>	<u>Code and Explanation Indicates</u>
Chaff Dispenser and Water Station	64	0 - Neither applicable 1 - Chaff observed, water station worked 2 - Chaff observed, water station failed 3 - Chaff not observed, water station worked 4 - Chaff not observed, water station failed 5 - Chaff observed 6 - Chaff not observed 7 - Water station functioned 8 - Water station functioned partially 9 - Water station failed
Air Recovery Attempted	65	0 - No air recovery attempted 1 - Air to air only, successful 3 - Air to air, out down failed 4 - Air to air, drogue chute failed 5 - Air to air, drogue chute tore 6 - Air to air, missed 7 - Air to air, aircraft equipment failed 8 - Air to water only, successful 9 - Air to water only, failed X - Air to air and air to water failed
Disposition	66-67	Where known, these two columns describe the reasons for success or failure. On strays (ones that flew but did not go where intended) these columns will be blank.

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<u>Column Title</u>	<u>Column Numbers</u>	<u>Code and Explanation</u>	<u>Digi Indicates</u>
Disposition	66-67	10 - Balloon rejected or cut down	
		11 - Aborted launch, balloon	
		12 - Aborted launch, instrumentation	
		13 - Aborted launch, package	
		14 - Aborted launch, handling	
		15 - Aborted launch, weather	
		21 - Failed in ascent, under-inflated	
		22 - Failed in ascent, leaker	
		23 - Failed in ascent, burster	
		24 - Failed in ascent, trapped	
		25 - Failed in ascent, hazard	
		26 - Failed in ascent, unknown	
		27 - Failed in ascent, weather	
		28 - Test	
		50 - Administrative decision, expired	
		60 - Not recovered after cut down	
		71 - No known cut down, recovered water	
		72 - No known cut down, recovered land	
		81 - Recovered, air to air	
		82 - Recovered, air to water	
		83 - Recovered, water, U.S. services	
		84 - Recovered, water by other than U.S. Forces	
		85 - Recovered, land, by U.S. forces	
		86 - Recovered, land, by other than U.S. Forces	

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<u>Column Title</u>	<u>Column Numbers</u>	<u>Code and Explanation Digit Indicates</u>
Beacon and Hazel Units	68	0 - Neither applicable 1 - Both functioned properly 2 - Beacon partial; Hazel O.K. 3 - Beacon failed; Hazel O.K. 4 - Beacon partial; Hazel partial 5 - Beacon partial; Hazel failed 6 - Beacon failed, Hazel partial 7 - Beacon failed, Hazel failed 9 - Hazel O.K. X - Hazel partial J - Hazel Failed
Date of Disposition	69-71	These will be filled in only on vehicles cut down. The first digit indicates the day, the next two, the month. (Zulu) This is the day and month of recovery, except in the case of those cut down but not recovered. On these it is the date of cut down.
Duration of Flight in Hours	72-74	Self Explanatory
Condition of Package	75	Following codes are self explanatory and refer to the package at time of recovery. 1 - No damage noted 2 - Slightly damaged 3 - Heavily damaged 4 - Irreparably damaged

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<u>Column Title</u>	<u>Column Numbers</u>	<u>Code and Explanation</u> <u>Indicates</u>
Results	76	Refers to camera package and is based on the processing reports from Reconnaissance Technical Squadrons. 0 - Not applicable 1 - Worked 2 - Worked partially 3 - Failed
Average Ground Speed	77-78	From launch to termination in 10's of knots.
Average Ground Speed First Fix to Termination	79-80	From location of first fix to termination in 10's of knots

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PART II

MACHINE RUN

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1023	030	2	4	11906	2	1408	233	07	50	2214	1912	04	1	15	2	4	0	0	0	50											
1024	031	2	4	11908	3	1416	233	07	50	2216	1914	04	1	14	2	1	4	0	0	50											
1033	032	2	4	11910	3	1425	233	06	50	2218	1916	07	1	13	2	1	2212	42	1	2	21	5	1	21	1	123	031	1	2	06	07
1032	033	1	4	11924	1	0437	161	07	46	2308	2006	05	1	11	2	1	4	0	0	0	50										
1034	034	1	4	11924	1	0459	161	07	46	2308	2006	05	1	13	2	2	2	0	0	0	26										
1035	035	1	4	12001	1	0439	161	07	46	2309	2007	05	1	16	2	4	0	0	0	50											
1036	036	1	4	12003	1	0381	161	07	46	2311	2009	05	1	13	2	4	0	0	0	50											
1037	037	2	4	12012	3	1300	233	097	07	50	2320	2018	08	0	3	0	1	0	15	3	0	23									
1038	038	2	4	12014	3	1312	233	06	50	2322	2020		1	15	2	4	0	0	0	50											
1039	039	2	4	12016	1	1305	233	07	50	2324	2022	04	0	2	0	1	0	14	2	3	0	22									
1040	040	2	4	12018	1	0820	233	06	50	2402	2024	04	1	15	2	4				50											
1041	041	2	4	12024	1	1403	233	07	50	2402	2106	07	1	15	2	4	0			50											
1042	042	2	4	12101	1	1423	233	06	50	2409	2107	07	1	15	2	4	0	0	0	50											
1043	043	2	4	12102	1	0817	233	097	06	50	2410	2108	15	0	2	0	3	14	2	3	0	20	27								
1044	044	1	4	12124	1	0835	161	07	46	2509	2206	08	1	14	2	4	0	0	0	50											
1045	045	1	4	12201	1	0800	161	07	46	2509	2207	09	1	14	2	4	0	0	0	50											
1046	046	1	4	12201	1	0816	161	07	46	2509	2207	12	1	13	2	4	0	0	0	50											
1049	047	2	4	12311	3	1426	233	097	07	50	2619	2217	11	0	3	0	1	0	07	2	3	0	22								
1050	048	2	4	12313	3	1407	233	06	50	2621	2319	10	1	15	2	4	0	0	0	50											
1051	049	2	4	12315	3	1432	233	06	50	2623	2321	07	1	13	2	4	0	0	0	50											
1047	050	1	4	12318	1	0815	161	09	46	2902	2603	05	2	17	2	3	0			26											
1048	051	1	4	12318	1	0804	161	06	46	2902	2603	12	1	13	2	4	0	0	0	50											
1052	052	1	4	12318	1	0778	161	07	46	2902	2604	12	1	17	2	2910	16	4	0	0	0	50									
1053	053	1	4	12320	1	0820	161	08	46	2904	2605	07	1	14	2	4	0	0	0	50											
1054	054	1	4	12320	1	0809	161	07	46	2904	2605	07	1	10	2	2714	07	4	0	0	0	50									
1055	055	1	4	12321	1	0770	161	09	46	2905	2606	10	1	14	2	2106	1	1	40	0	0	34	9	201	125	1	2	04	04		
1056	056	1	4	12322	1	0772	161	06	46	2906	2607	10	1	15	2	4	0	0	0	50											
1057	057	1	4	12323	1	0830	161	09	46	2907	2608	11	1	14	2	2912	00	1	2	21	0	1	01	131	123	1	1	04	05		
1058	058	1	4	12324	1	0784	161	06	46	2908	2702	11	1	14	2	4	0	0	0	50											

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2005 010	1 3	11124	1 1024	163	07	46	1402	1209	10	1	1	1	1	1	1	1	1	1	1	1	1
2007 011	1 3	11124	1 1024	163	07	46	1402	1209	10	1	1	1	1	1	1	1	1	1	1	1	1
2009 012	1 3	11224	1 1024	164	07	46	1602	1502	10	1	1	1	1	1	1	1	1	1	1	1	1
2011 013	1 3	11324	1 1017	164	07	46	1602	1502	10	1	1	1	1	1	1	1	1	1	1	1	1
2013 014	1 3	11401	1 1033	267	07	46	1602	1504	10	1	1	1	1	1	1	1	1	1	1	1	1
2015 015	1 3	11402	1 1003	164	07	46	1604	1505	10	1	1	1	1	1	1	1	1	1	1	1	1
2016 016	2 3	11518	1 1124	234	07	50	1720	1609	03	1	1	1	1	1	1	1	1	1	1	1	1
2017 017	2 3	11519	1 1123	235	07	50	1721	1610	05	1	1	1	1	1	1	1	1	1	1	1	1
2018 018	2 3	11520	1 1122	235	07	50	1722	1611	10	1	1	1	1	1	1	1	1	1	1	1	1
2019 019	1 3	11521	1 0114	163	07	46	1723	1612	10	1	1	1	1	1	1	1	1	1	1	1	1
2021 020	1 3	11523	1 0143	163	07	46	1801	1614	10	1	1	1	1	1	1	1	1	1	1	1	1
2022 021	1 3	11605	1 0095		07	46	1817	1620		1	1	1	1	1	1	1	1	1	1	1	1
2023 022	2 3	11624	1 1130		07	50	1902	1803		1	1	1	1	1	1	1	1	1	1	1	1
2023 023	2 3	11624	1 1129		07	50	1902	1803		1	1	1	1	1	1	1	1	1	1	1	1
2024 024	2 3	11701	1 1128	236	099	07	50	1903	1804	12	3	0	0	0	0	0	0	0	0	0	0
2025 025	2 3	11702	1 1127		07	50	1904	1805		1	1	1	1	1	1	1	1	1	1	1	1
2026 026	2 3	11705	2 1131		07	50	1907	1808		1	1	1	1	1	1	1	1	1	1	1	1
2027 027	1 3	11807	3 0123		07	46	2009	1910		1	1	1	1	1	1	1	1	1	1	1	1
2028 028	1 3	11813	3 0125		07	46	2015	1916		1	1	1	1	1	1	1	1	1	1	1	1
2029 029	1 3	11814	3 0141		07	46	2016	1917		1	1	1	1	1	1	1	1	1	1	1	1
2030 030	1 3	11815	1 0132		07	46	2017	1918		1	1	1	1	1	1	1	1	1	1	1	1
2031 031	2 3	11817	1 1126		07	50	2019	1920		1	1	1	1	1	1	1	1	1	1	1	1
2032 032	2 3	11818	1 1125		07	50	2020	1921		1	1	1	1	1	1	1	1	1	1	1	1
2033 033	2 3	11819	1 1124		07	50	2021	1910		1	1	1	1	1	1	1	1	1	1	1	1
2034 034	1 3	11820	1 0103		07	46	2022	1911		1	1	1	1	1	1	1	1	1	1	1	1
2035 035	1 3	11820	1 0019		07	46	2022	1911		1	1	1	1	1	1	1	1	1	1	1	1
2036 036	1 3	11821	1 0004		07	46	2023	1912		1	1	1	1	1	1	1	1	1	1	1	1
2039 037	2 3	11823	1 1122		07	50	2101	1914		1	1	1	1	1	1	1	1	1	1	1	1
2038 038	1 3	11824	1 1003		07	46	2102	1915		1	1	1	1	1	1	1	1	1	1	1	1

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2037 039	1 3 11901 1 0117	07 46	2103 1016	1	1	2103 30 1 2 22	0 40	121 062	03 17
2040 040	1 3 11911 3 0122	07 46	2113 2002	1	1	2117 30 1 2 21	0 36	122 071	1 03 14
2041 041	2 3 11912 3 1122	07 50	2114 2003		1	2116 30 2 1	0 0 50		
2042 042	2 3 11913 3 1121	234 099 07 50	2115 2004 12 0 5 0	1 0	3 0	37 3	23		
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